ELECTRICAL REVIEW

25th SEPTEMBER, 1953

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS
Technical Editor: P. W. TUCKER, M.I.E.E. *Technical Consultant:* C. O. BRETTELLE, M.I.E.E.

IN THIS ISSUE

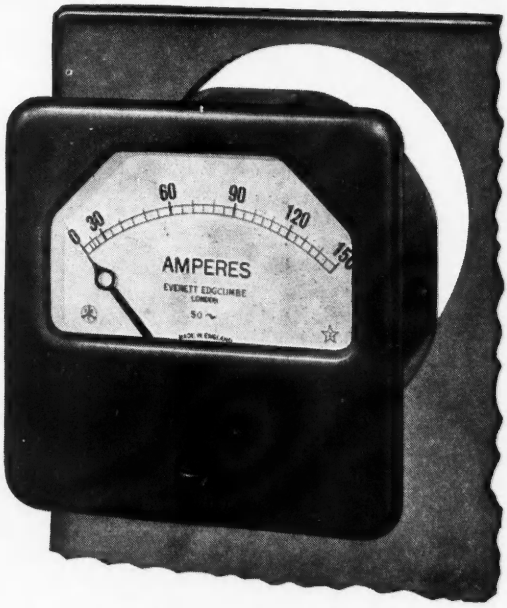
Illumination Prospects	657
Public Lighting	659
A.P.L.E. Conference	661
Cold Cathode Lighting	667
Trends in Industrial Lighting	668
Office Lighting	671
I.E.E. Centre Chairmen	675
Next Week's Events	676
Views on the News	677
Personal and Social	678
Portable Insulation Test Set	685
Railway Signalling	689
Commerce and Industry	691
Recent Introductions	695
Electricity Supply	697
Engineering in Europe	701
A.C. Tripping Circuits	703
Financial Section	706
New Patents	711
Contract Information	713
Classified Advertisements	153
Index to Advertisers	166

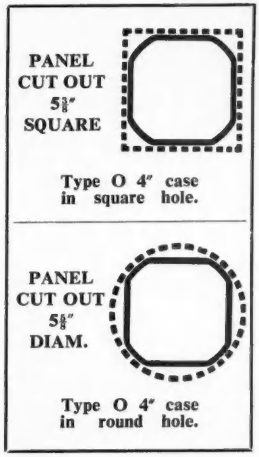
VOL. 153: No. 13
Eighty-First Year
Fridays: Price 1/-

EDITORIAL, ADVERTISING & PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home and Overseas £3 6s 0d: U.S.A. and Canada $11.00. Cheques & P.O.s (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD. and crossed "Lloyds Bank."

4″ Square Flush Instruments

EARLY DELIVERY





The Square Instruments introduced by Everett Edgcumbe about eight years ago received favourable comment for their appearance, finish and performance.

A NEW PATTERN (TYPE O) 4″ FLUSH CASE IS NOW IN PRODUCTION, REQUIRING ONE CIRCULAR HOLE FOR MOUNTING.

The frontal appearance has been preserved and the new round body will also fit the square hole required by the original Type R.

The full range of movements available in the Type R case are made in the Type O.

EVERETT EDGCUMBE

CATALOGUE SHEET: Nº 115A

Makers of Electrical Instruments for Indicating, Recording and Controlling ; Photometric Apparatus ; Process Controls.

COLINDALE WORKS LONDON N.W.9 TEL : COLINDALE 6045

ELECTRICAL REVIEW 25th SEPTEMBER, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. 153 • NO. 13

Illumination Prospects

LIGHTING, one of the earliest applications of electricity and still, in a sense, the most important, is by no means at the end of its progress. From the arc (still in use for a number of purposes) to the glowing filament marked a great advance; the electric discharge is working a revolution. That is not to say that the incandescent filament lamp is finished; it will be a long time before the public is convinced that the discharge lamp is a better substitute. Indeed the technology of the discharge lamp has not yet reached its limits and the adaptation of this form of illumination to the domestic interior has by no means been perfected.

Yet in the realms of public lighting, particularly, the discharge lamp is making rapid headway. Probably most of the schemes for new and improved street lighting now call for this form of illuminant. The question seems nowadays to be not whether discharge lamps shall be installed but what form of discharge lamp —mercury-vapour, sodium or fluorescent. Recent correspondence in the *Electrical Review*, following an article by Mr. F. H. Pulvermacher, has pursued this question of choice, on comparative efficiencies and costs. The article dealt particularly with the lighting of trunk roads but some of the correspondents have treated the matter generally. After studying the various letters the reader will form the opinion that even the costs of the three systems are not easily compared, let alone the "æsthetic" values, whic hare what the public judge lighting by. Much, of course, depends on the lanterns employed and recent improvements in this direction are touched upon by Mr. C. Hughes in his article on page 659. Other street lighting developments and considerations were discussed at last week's A.P.L.E. conference (see page 661). Æsthetics are not so important in factories where the principal requirements are adequate and correct illumination of working areas and the work itself. This implies good definition and comfortable vision and in many cases good colour-rendering. In this case the choice lies

between tungsten, mercury-vapour and fluorescent lamps and a combination of tungsten and mercury-vapour is widely favoured, as Mr. E. B. Sawyer mentions in this issue (page 668). The lighting of offices, although also primarily a matter of facilitating work, reintroduces the decorative or æsthetic aspect. Methods of treatment for various establishments of this kind are suggested in an article by Mr. R. L. C. Tate on page 671 of this issue. These articles and discussions will all serve to show that the electric lighting business has still a tremendous future and also needs expert handling.

ROAD SAFETY

Suggestions made at last week's conference of the Association of Public Lighting Engineers that the B.S. Code of Practice should be modified to make possible a wider, if not so effective, application of street lighting, in these days of restrictions on expenditure, should be resisted. Statistics show the increase in road accidents during the hours of darkness, mainly in lighted thoroughfares, and this may be attributable to the inadequacy or unsuitability of the lighting. There is a strong case for the relaxation of restrictions on expenditure for this purpose and also much to be said for Mr. E. C. Lennox's proposal that the insurance companies, which are very much concerned, might help to finance the cost of street lighting.

I.E.E. BENEVOLENT FUND

It seems a pity that although the membership of the Institution of Electrical Engineers has increased materially during the past twelve months, there has again been a drop in the amount subscribed to the Benevolent Fund. This has resulted in the income failing to cover the expenditure, which is not likely to decrease during the coming years. The governors in their report point out that if those I.E.E. members not now contributing would send only 5s each per annum the revenue would be increased by over £5,000. Further help could be given if all subscribers of 10s or more per annum, who pay income tax at the full standard rate, would complete covenants promising to pay the same amount for seven years, as in this way a further £5,000 would be obtained from the Commissioners of Inland Revenue.

INTERNATIONAL EXCHANGE

Another two-way power transmission scheme between adjacent countries is under way on the Canadian–United States border. Two links capable of carrying 300 MW are being erected between the systems of the Hydro-Electric Power Commission of Ontario and the Detroit Edison Co., one from Windsor, Ont., to the company's Delray plant and the other from Sarnia, Ont., to Marysville, Michigan. The two systems are complementary for in spring when Canadian water power is abundant the Commission will supply energy to augment the company's output and during the summer months when water is low the company will provide a surplus from its steam plant.

BREAD UPON THE WATERS

Although the balance of the South West Scotland Electricity Board was slightly on the wrong side last year the Board has just announced concessions to industrial and commercial users which will cost it £34,000 a year —unless the concessions result in a greater demand. There is to be a reduction in the coal-clause increment for h.v. consumers but the major concession is a reduced rate for consumers whose load factor exceeds 50 per cent. This is designed to further stimulate off-peak use; the Board already has " incentive " tariffs. Another sensible innovation is the alteration of the coal-cost basis from 38s a ton to 60s—a more realistic figure.

Public Lighting

Review of Recent Developments

By C. HUGHES, A.M.I.E.E., F.I.E.S.

RECENT years have seen a progressive increase in the application of electricity for street lighting in preference to other forms of illumination, and this Coronation year in particular has provided many interesting examples of public lighting as part of the national celebrations.

An increasing realization of the necessity for doing something to reduce the toll of traffic accidents has tended to make local authorities and even the general public more conscious of the need for good street lighting. Quite recently the citizens of Cambridge were invited to choose the form of street lighting they preferred out of a number of various types erected by the city authorities. Public interest is also evidenced by recent correspondence in *The Times* on the subject of lamp-posts and colour rendering of various forms of electrical illumination.

Mr. Hughes is President of the Electric Light Fittings Association

In the new towns now coming into being the question of the lighting of streets and public places has received considerable attention from the architects responsible for layout and design.

In general, the illumination level of street lighting has tended to increase—due not only to the introduction of improved light sources by the electric lamp manufacturers, but also to improvements in the design of equipment that makes the best use of new or improved lamps. At the same time, British Standard codes of practice recommended by the Ministry of Transport are being widely adopted—although it is unfortunate that loans from public funds are sometimes granted only for the lower-priced scheme which may not be the most suitable for a given problem.

Because economy in current consumption is of paramount importance, the tendency in the past few years has been towards sodium lighting. In addition to a saving in consumption, sodium lamps operate at a comparatively low temperature which allows a greater use of plastics in the construction of lanterns, and at least one manufacturer has marketed a lantern constructed entirely of plastic material.

The question of decorative appearance of lanterns and columns is receiving considerable attention, and manufacturers are co-operating with the Council of Industrial Design, whose artists, by the way, seem to favour the simple post-top unit in preference to the swan-neck bracket.

One interesting development is the wall-mounting type of lantern housing fluorescent tubes, and several experimental installations utilizing this linear form of lamp have been made—some using the lamp horizontally along shop fronts and others using vertical lanterns affixed to buildings. This scheme has the great advantage of eliminating the need for poles which, in narrow streets, can cause serious obstruction to the footway.

An interesting example of this type of installation is in the City of London. The City Fathers have a traditional right, dating back for centuries, that gives them power to fix street lighting equipment to any building, and the power has been made use of in the Coronation installation near the ancient Guildhall. The daylight appearance is unobtrusive and in keeping with the surroundings, while the effect by night is extremely good. The three 80 W fluorescent tubes are fitted with a "Perspex" cover which has machined

prisms for controlling the light distribution.

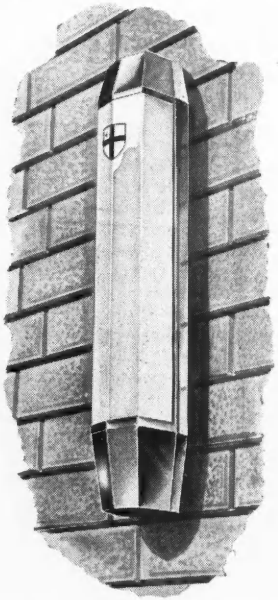
The use of fluorescent tubular lamps for street illumination is increasing, as this form of lighting is particularly suitable for city centres, squares, etc. Because an 80 W fluorescent tube is five feet in length, however, the designers are somewhat restricted, especially in view of the fact that the control gear and chokes add weight to the unit. To minimize this, one manufacturer has developed a form of fluorescent tube lantern where the chamber containing the control gear is separate from the lantern, the two parts being bolted together around the top of the post. In this arrangement, the pole becomes the centre of gravity and the control box acts as a counterbalance to the weight of the lantern.

An interesting trial is being carried out in Liverpool using cold cathode tubes, which, of course, require a much higher operating voltage than the more conventional hot cathode lamp.

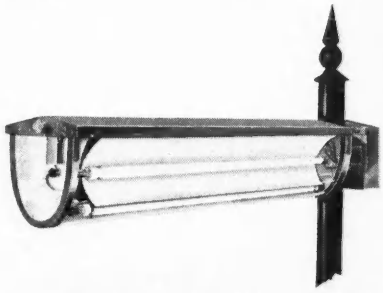
The Ministry of Transport, in dealing with schemes put forward by local authorities concerning high pressure mercury · vapour lamps, has shown a preference for lanterns in which lamps are operated in a horizontal position. The drum type Holophane refractor employing sodium lamps is a very interesting development in so far as, by rotating the refractor, adjustment can be made to accommodate the gradient of the road level and plane of illumination. It has a further advantage in that it is a completely dust-proof unit which reduces the expense of maintenance —an all-important feature in the cost of street lighting schemes.

Almost all new installations of street lighting employ one form or another of electric discharge lamps, and the leading lamp makers have recently introduced several improved types, notably the 80 W and 125 W high pressure mercury vapour lamps with a fluorescent coating, which are now available in considerably smaller "bulbs" and with a new fluorescent powder coating giving an improved colour rendering.

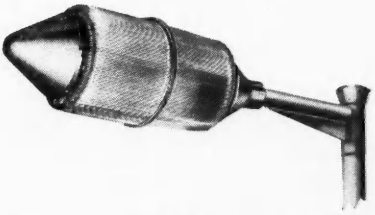
It will be only too obvious to many readers that quite frequently the appearance of a scheme is ruined by the use of an



Wall-type fluorescent lamp fitting designed for the City of London



A pole-mounting fitting in which the weight of the lantern is counterbalanced by the separate control box



Drum type rotating refractor adjustable to suit different road gradients and planes of illumination

insignificant lantern hung on to a projection from a massive concrete pole. It is fundamentally clear that the designer must have some regard for æsthetic appearance in his main consideration of light distribution. The problems of maintenance, too, must be carefully weighed in the consideration of schemes.

For a number of years members of the Electric Light Fittings Association have investigated all these aspects of efficient street lighting and have been active supporters of the Association of Public Lighting Engineers. It is from this close collaboration that the best equipment will emerge, fulfilling the vital need for well-lit streets with a sensible and pleasing æsthetic approach.

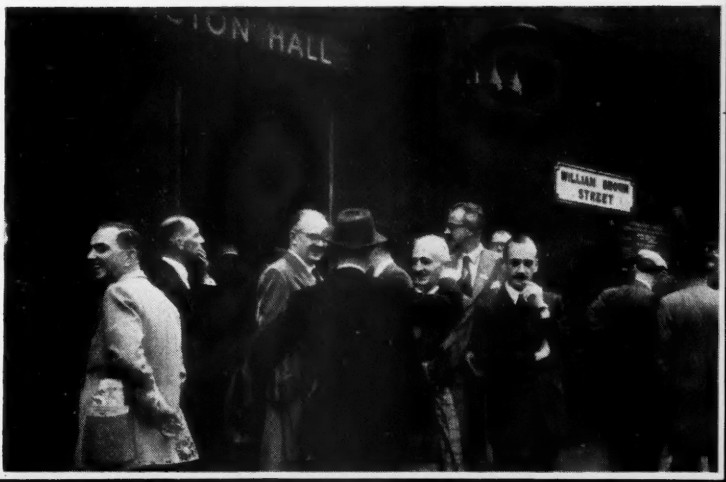
A.P.L.E. Conference

Report of Discussions at Liverpool

AT last week's conference of the Association of Public Lighting Engineers, at Liverpool, the first paper which followed the presidential address by Mr. C. C. Smith, city lighting engineer, Liverpool (reported in our last week's issue), had as its title "The Utilization Factor in Public Lighting." As it was by an official of the Wales Gas Board's Neath undertaking (Mr. Geoffrey Fitton) it might have been supposed to have been of little electrical interest, but the subject was treated in such broad terms that it was of almost equal concern to both branches of the lighting industry.

The author divided his paper into three sections, dealing with the utilization factor of the light produced, capital resources and existing equipment. He presented arguments for not adopting high mounting on certain roads which were otherwise suitable for lamps with a 15ft mounting height and focused particular attention on the proportion of light falling on the roadway, citing as an example the case of a unit mounted at 25ft, giving only 21 per cent of its illumination on an 18ft roadway, compared with 35 per cent on a 35ft roadway.

There was a limit to what could be achieved in the improvement of utilization from high mounted units by adjustments of the optical system and a more promising approach arose from the avoidance of unnecessary high mounting in narrow roads. Good lighting was, of course, not assessed solely by the criterion of the amount of light on the road; other factors entered into the achievement of good visibility. Nevertheless, with other things equal, it was obviously desirable to apply the maximum amount of light to the road



Delegates arriving at Picton Hall for Wednesday morning's session

Mr. J. B. de Boer (Light Technical Laboratories, Eindhoven) and Mrs. de Boer and (right) Sir Harold Hartley (Chairman, Electricity Supply Research Council), Mr. J. Eccles (Chairman, Merseyside & North Wales Electricity Board) and Mrs. Eccles

surface and a higher "utilization factor" than 20 per cent on the carriageway was most desirable.

The ultimate aim of all lighting authorities must be to provide uniformly effective illumination, appropriate to the requirements of each class of road. In striving towards this, any new installations must be well planned and implemented. Nevertheless many cases could be quoted where, by a rigid adherence to the Code of Practice, installations had been constructed which were either in excess of reasonable requirements for the particular road, or were ahead of traffic development and so could have been deferred. There might be cases where intermediate standards of lighting could be devised which would suffice as interim measures. If the demands of one particular section were reduced the overall permitted expenditure would enable more sections to receive attention.

To open the discussion a number of comments by Mr. Norman Hudson (North Eastern Gas Board), who was unable to be present, were read by Mr. F. C. Smith (North Thames Gas Board). Pointing out that the declared aim of improved lighting within the Code of Practice was uniformity of lighting, Mr. Hudson said that many people interpreted this as uniformity of installation, and even illuminant, rather than uniformity of lighting effect and resultant visibility. He instanced another example of the serious drop which occurred when the mounting height used was unnecessarily high in relation to road width.

To secure uniformity of lighting effect and resultant visibility on the roads and to achieve this at the lowest cost, for a given spacing of lighting units along a particular road, should there be not only an appropriate mounting height related to road width but also an appropriate total flux emission from the lantern related to mounting height?

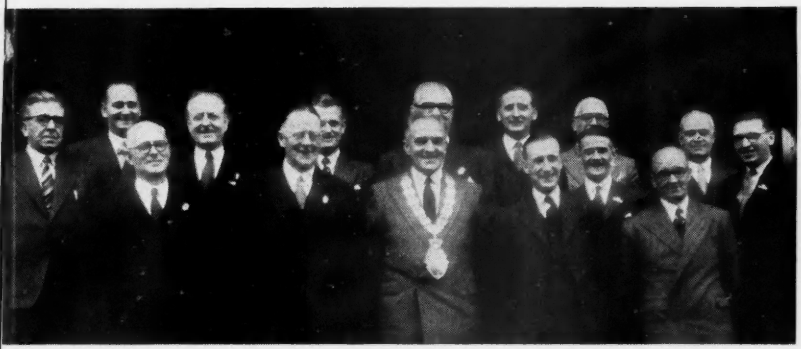
Again, where the Code of Practice was rigidly applied to all new and/or reconstructed roads the result was often that the architectural character of some of them was ruined. He suggested that if existing street furniture was particularly appropriate it should be retained even though a scheme to improve road visibility was to be adopted.

Mr. A. J. Harris (Road Research Laboratories) said that on some road surfaces a higher lamp might improve the effective road brightness. In its effect on relative efficiency the road surface by itself was as important as the lighting.

Mr. M. V. Osmond (Council for the Preservation of Rural England) declared that there were few subjects which were causing the man in the street more anxiety than methods of lighting streets. He did not know how well this was appreciated in the public lighting profession.

Mr. E. H. Jesty (London Electricity Board) said there were powerful arguments for adopting 25ft mounting, including the reduction of malicious damage to the lighting units.

Mr. E. R. Knight (Fulham) pointed out that 100 per cent efficiency did not mean 100 per cent lighting on the road and it was desirable to have a considerable



The Council of the Association of Public Lighting Engineers

Left to right: Messrs. F. C. Smith, H. Carpenter, A. S. Tapsfield, E. C. Lennox, E. Howard, N. Boydell, C. C. Smith (president), H. Pryce-Jones, H. F. Cork, L. A. Doxey (vice-president), E. Stroud, E. Evans, H. C. Brown, J. M. Ward and R. Parker

amount of light on the adjacent buildings.

Mr. W. Robinson (E.D.A.) said that the utilization factor could not be taken as the criterion for good street lighting. They should not permit the lowering of the standard of lighting required by the Code of Practice and he urged action to get the brake on street lighting expenditure removed.

Mr. F. C. Smith agreed that with the present capital restrictions it was foolish to put up high columns on roads where lower columns would suffice, at the expense of improvements on other roads.

Opening the discussion on Wednesday morning's paper by Mr. J. B. de Boer (Light Technical Laboratory, Eindhoven) on "Criteria in the Quality of Street Lighting," Mr. J. G. Holmes (Holophane, Ltd.) said that experts rarely agreed on what was right, but all were interested in the quality of street lighting. To achieve this a number of factors were concerned: the lanterns had to look right, there had to be enough light, and the lanterns had to be mounted as high and as close as possible. It was a reasonable requirement that glare should be no worse than daylight glare and it must be possible to see obstructions on traffic routes as soon as possible. The lighting of double carriageways would be more efficient if the lanterns were unidirectional. To achieve really good quality a still higher criterion for road brightness should be adopted than the 0·15 effective foot-candles mentioned by Mr. de Boer. He suggested that fluorescent units might produce more dazzle effect than other light sources.

Mr. A. W. Christie (Road Research Laboratory) thought that in the avoidance of glare the advantage lay with the cut-off system, which might even result in an increase in revealing power. This system had its disadvantages, however, for the spacing must be short and the suspension methods were not very attractive.

Mr. W. Robinson (E.D.A.) questioned Mr. Holmes's suggestion that fluorescent lighting might produce more dazzle effect. It might be possible to compare on a quality basis the relative merits of different types of light sources.

Mr. H. R. Ruff (B.T.H. Research) asked if representation photography had proved of any value in investigations.

Replying to points raised, Mr. de Boer agreed that the level of illumination should be higher. From the lighting disability point of view the dimensions of the light source were not very important, but they had noticed that with the large fluorescent fittings the visibility was not so good, because the large dimensions made the contrasts on objects themselves much smaller. With regard to cut-off systems there was a danger that central suspension might attract traffic towards the centre of the road.

At the annual luncheon which followed, the Deputy Lord Mayor, Alderman Albert Morrow, replied to the toast of "The City and Port of Liverpool and the Guests," proposed by Mr. H. Pryce-Jones, past-president of the Association. He said that the street lighting in Liverpool had no equal in the country. There were now

34,000 lamps in service. The city had been a pioneer of sodium lighting. .

Proposing the toast of the Association, Sir Harold Hartley, chairman of the British Electricity Research Council, said that much was owed to the Association for its contribution towards safety on the roads. In his lifetime there had been rapid changes in street lighting due partly to scientific research but also to competition between gas and electricity. He was glad that in this particular field there was this incentive of competition and there was no danger of the stagnation of uniformity. They must be proud of the vitality of the Association, evidenced by the inauguration of new sections and the introduction of the diploma. They must look back, too, with pride on the lighting during the recent Coronation festivities, which showed great skill and architectural taste.

In reply, the president said that the Association was increasing in strength and status. The assistance in helping the police in ensuring law and order was not the least of the services performed by the lighting engineer. The bulk of the credit for progress was due to the research men of the industry who had produced the many light sources available. The final results were, however, obtained through team work between the engineer, the salesman and the public representative.

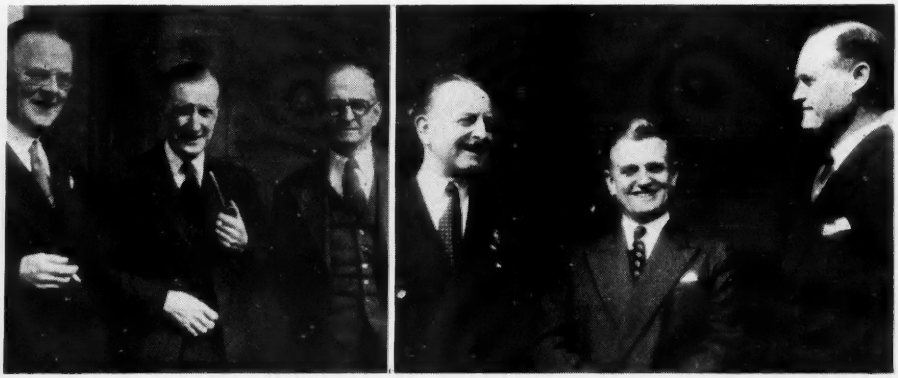
Discussing Thursday morning's paper by Mr. M. H. Mounsdon (G.E.C.) on "The Design and Manufacture of Street Lighting Lanterns," Mr. W. F. Griffiths (Crompton Parkinson) pointed out that the lantern accounted for only a small portion of the cost of a street lighting installation but unless it performed its function the scheme failed. It was one thing to produce a lantern which would light a road well when it was installed but quite another to make one which would continue to do so for 15–20 years. He was surprised the author had not mentioned the need for good æsthetic design. Design for transport and storage should also be considered.

Mr. F. H. Pulvermacher (South Wales Electricity Board) said that the user looked at a lantern from the point of view of suitability for its job, maintenance, ease of mounting, daylight appearance and cost. It was false economy to save a couple of pounds on a fitting costing £50 at the risk of losing 30–40 per cent efficiency. He asked manufacturers for uniformity in isocandle diagrams and the inclusion of utilization factors in their catalogues.

Maintenance should receive greater attention, particularly with regard to insect- and dust-proofing; smooth surfaces, externally and preferably internally too; resistance to corrosion, particularly in coastal and industrial areas; and resistance to electrolytic action. He hoped that a really permanent surface for diffusing reflectors would be developed.

Mr. M. V. Osmond (Council for the Preservation of Rural England) commented on the lack of harmony between the lantern and its mounting and asked at what stage of production there was liaison

Messrs. E. Howard (Nottingham), L. A. Doxey (Leeds) and Councillor A. Brown (Leeds) and (right) Messrs. E. C. Lennox (Sunderland), N. Boydell (Eastbourne) and E. B. Sawyer (E.L.M.A.)



in their design. In this matter was the advice of the Council of Industrial Design taken?

Mr. W. G. Parkinson (Merseyside and N. Wales E.B.) asked to what temperatures the wiring of lanterns was subject and if any lessons had been learnt from the investigations. Mr. A. J. Dalton (South Wales E.B.) said that as the electrical distribution in villages had to be by overhead lines and poles, the selection of design of the lantern and standard had no bearing on the matter as far as rural districts were concerned.

Alderman F. Doggett (City of Cambridge) asked whether there was any ageing of "Perspex" and if so was there any loss in light transmission. The effects of the ageing of aluminium were raised by Mr. R. J. Rennie (S.W. Scotland E.B.).

Replying to the questions raised Mr. Mounsdon said that synthetic paints were being developed which would probably replace vitreous enamel for reflectors. Most manufacturers sent their designs to the Council of Industrial Design for approval but it was easier to get them rejected than to obtain any constructive criticism for improvements. Liaison between designers of lanterns and columns was difficult since lantern makers had to make their units fit any pole. Manufacturers endeavoured to control the temperature of the lamp cap and if this was not overheated the wiring would undoubtedly be all right. "Perspex" lanterns had been in use for seven years without undue ageing effects, the very small loss in light transmission due to surface abrasion being nothing to worry about. Provided a silicon alloy was used there should not be any trouble with aluminium reflectors.

Mr. E. C. Lennox (Sunderland) opened the discussion on the paper on "Public Lighting in Belgium" presented by M. André Boereboom (General Director of Electricity and Electromechanics, Ministry of Public Works, Belgium, and president of the National Belgian Commission on Public Lighting). He asked various questions relating to experiences with the 135 W high pressure mercury vapour lamps just introduced in this country, to tilting of the lamps, Belgian legislation, and street lighting subsidies.

Taking into consideration the increased traffic density in daylight Mr. Lennox thought that the figure of two and a half times as many adult pedestrians killed in this country each hour between dusk and midnight, as during each hour of daylight was comparable with the figure of five times given by Mr. Boereboom for Belgium. Street accidents were costing this country £150 million a year but for a sum of only £3 million a year the position could be vastly improved. If the insurance companies could not themselves give this money they could at least provide interest-free loans to street lighting authorities.

Mr. Lennox asked why the police did not call in independent lighting engineers in the case of accidents. He questioned whether illuminations such as those at Blackpool and elsewhere were really worth while and thought that the improvement of the night appearance of architectural features of a town as had been done at Bruges was another matter. In this country we were not going ahead fast enough with fluorescent lighting which was no longer a luxury and had a very real psychological effect.

Mr. E. H. Jesty (London E.B.) praised the pioneering spirit of Belgium, where street lighting accounted for 2·3 per cent

The Deputy Lord Mayor of Liverpool (Ald. Albert Morrow) inspects the outdoor exhibits

of the total electricity distributed compared with under 1 per cent in this country. He wondered how much the lower figure here was due to increased lighting efficiency.

Mr. Howard Long (Benjamin Electric, Ltd.) commented on the references to the quality of street lighting that occurred in all the papers read and emphasized the value of cut-off lighting which he claimed not only saved people's lives but much money too. He could not understand why cut-off lighting was not employed on fluorescent fittings.

M. L. Gaymard (Electricité de France) said that in France they had found that the best results were obtained through tilting lanterns to 10–25 per cent to the horizontal and in a recent installation had even tilted them to 45 deg. Mr. George Williams (Council of Industrial Design) spoke of the increasing attention to the appearance of street lighting furniture. His Council, rather than having a stultifying effect, was encouraging variation of design and had in fact approved 300 designs for street lighting fittings.

Mr. H. F. Cork (Manchester) remarked that if the paper gave the impression that we were behind Belgium in street lighting, this was due to the prevailing restrictions rather than to lack of initiative or technical skill.

Replying, Mr. Boereboom said that the new 125 W mercury vapour lamp maintained its colour satisfactorily and was generally used in a vertical or 15 deg tilting position, with reflectors rather than refractors. He thought tilting was just a matter of habit in his country. They had endeavoured to get insurance companies to take a financial interest in street lighting but so far it had been possible only to get them to become members of the Via Secura, the Belgian equivalent of our Society for the Prevention of Accidents. They still had a lot of gas lighting in Belgium but this was rapidly being replaced by electricity. At present the proportion of fluorescent to mercury was about 1 to 3, before long he thought it would be about 1 to 2.

In the series of papers "Know Your Materials," Mr. W. H. Lythgoe (Cable Makers' Association) dealt on Friday morning with "Electric Power Cables," tracing, with the aid of numerous lantern slides, the whole process of manufacture from the drawing of the copper conductors and the preparation of the rubber insulation and sheathing to the final testing. All types of insulation were dealt with, including p.v.c. and polythene, and special reference was made to protection against mechanical damage or external corrosive influences.

During the discussion Mr. A. E. Morgan (London E.B.) spoke of the improvements which had been made in the reliability of power cables and instanced the experiences in his area where for 2,000 miles of cable faults worked out at four and a half per 100 miles a year. Of these 37 per cent were due to mechanical damage and a similar percentage to joints and terminations. Faults occurred in street lighting columns due to their not being weatherproof and to insufficient attention being paid to the wiring up. The use of asbestos covered wiring at the top of the columns had overcome one source of failure.

Mr. H. Pryce-Jones asked questions about the quantity of water extracted during impregnation, the sticking of adjacent coils during vulcanizing and the temperature of the lead in extrusion. Mr. L. R. Osgood (Luton) mentioned difficulty experienced in baring cables, and Mr. W. G. Parkinson (Merseyside and N. Wales E.B.) raised the question of centralizing the conductor in p.v.c. cables. Mr. F. C. Smith (N. Thames Gas Board) asked what steps were taken to survey the ground before laying cables. Mr. J. M. Ward referred to troubles experienced at Glasgow due to birds at nesting time damaging overhead v.i.r. cables and the subsequent change-over to p.v.c. He also asked if the cracking of p.v.c. due to unsuitable plasticizers had been overcome.

Mr. Lythgoe said that many experiments had been undertaken to overcome corrosion troubles. Aluminium sheathed cables were more subject to corrosion than lead. It was important in corrosive soils to have an impervious layer of non-fibrous material. Regarding p.v.c. he thought that its use should be expanded but that it should be treated as an experiment until further experience was obtained. In an impregnating tank containing 2,000 yd of cable water was extracted literally by the bucketful. Adequate supplies of suitable plasticizers for p.v.c. were now available.

At the conclusion of the proceedings the president mentioned that next year's conference would be held at Eastbourne.

Cold Cathode Street Lighting

Liverpool Pioneer Installation

THE first section of a cold cathode fluorescent lighting scheme was switched on earlier his month at the Pier Head, Liverpool. This is believed to be the first street lighting installation in the world to employ vertical cold cathode fluorescent lanterns. The area selected by the Liverpool City Lighting Committee for this development feeds the Victoria Pier on the Mersey; it is about 120 yd wide and 250 yd long and is backed on the land side by the familiar skyline of the Liver, Cunard and Dock Board buildings. The complete scheme which will employ 50 new lanterns has been temporarily held up pending decisions on the situation of bus loading points. The first six lanterns have been installed between the Liver Building and the Floating Roadway, which marks the Northern boundary of the Pier Head. The General Electric Co., Ltd., designed and built the cold cathode lanterns employed and the Liverpool City Lighting Department, under Mr. C. C. Smith, A.M.I.E.E., was responsible for the layout and installation.

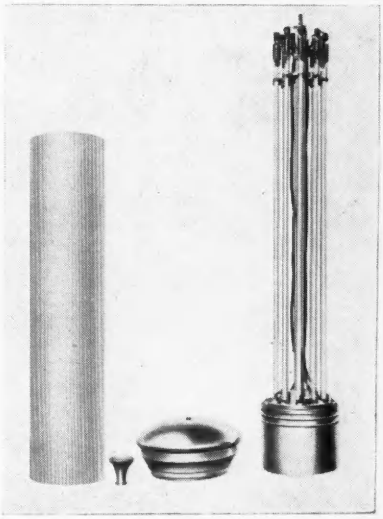
The decision to install cold cathode equipment was largely influenced by maintenance considerations; the lanterns have no complicated starter equipment and operate efficiently even under fluctuating voltage conditions. The use of "Osram" cold cathode fluorescent tubes, which have an average life of 15,000 hours, makes possible the construction of a street lighting lantern without doors and hinges, which can be sealed for long periods without attention. When eventually attention becomes necessary the complete lantern will be removed to the Lighting Department workshops.

The new lantern is designed for post-top mounting at a column height of 15–24ft and at a spacing of 100 to 150ft. In this installation the columns are 24ft high, giving a light centre about 27ft above the ground. The lantern houses five 67½ W cold cathode U-shaped tubes. Each tube has an average light output of 35 lumens/watt.

The lantern is built around a central steel tube screwed into a spigot cap at the lower end. The top of the cap is enlarged to the full diameter of the lantern and carries the operating transformers. An aluminium case protects the transformers and carries a "Sorbo" rubber gasket in a channel in its upper edge to make a seating for the reeded opal "Perspex" cylinder. At the top, a spun cover seats on to the cylinder and is held in place by the finial.

Decorative cold cathode fluorescent lantern seen against the background of the Royal Liver Building

Components of the lantern—"Perspex" cylinder, finial, spun cover, and spigot cap into which is screwed a central steel tube with spiders carrying fluorescent tubes in glass insulated clips



The central tube carries two spiders, one near the transformers and one near the top of the lantern. These are provided with glass insulated clips carrying the fluorescent tubes. The electrode ends of the tubes are inside the top spinning of the lantern, and the h.v. leads pass down the outside of the central tube to the secondaries of the transformers. The leads are contained within the lantern and three safety devices are fitted, one of which comes into operation as the top spinning is lifted off, while a second, near the transformers, operates as the cover over the transformers is removed. The third disconnects the supply in the event of any electrical fault developing inside the lantern.

Trends in Industrial Lighting

By E. B. SAWYER*

Installation Methods and Lamp Selection

ONE of the most interesting recent trends in industrial lighting has been the growing acceptance of continuous trunking systems developed by a number of manufacturers, generally for use with fluorescent lamps. These vary in detail, but all have the effect of simplifying installation and improving the appearance of what would otherwise be individually suspended reflectors. The trunking is of sufficient size to accommodate not only the necessary wiring for the lighting, but may also contain public address, alarm and other circuits which would normally require the trouble and expense of separate installation.

In addition, in some examples at least, the attachment, removal or change of position of individual reflectors is so simple that the system offers marked advantages in factories where it may be necessary from time to time to change the plant layout or operational areas, and particularly where such changes require a different spacing.

In the larger and loftier factories there has been a considerable revival of interest in colour-corrected mercury lighting, either by the use of supplementary tungsten lighting or by fluorescent-bulb mercury lamps. For many years combined mercury-tungsten (type MAT/V) lamps of moderate wattage have been available for this purpose, but recently the smaller (MBT/U) lamps down to 160 W have been added to the range. These types give a composite light with a red content of about 8 per cent and 11 per cent respectively (compared with 20 per cent for tungsten lamps alone, and 15 per cent for natural daylight) which is suitable for many industrial operations, and they need no auxiliary gear.

Where separate tungsten and mercury lamps are used, each is now usually in its own reflector so as to avoid the undesirable effect of an asymmetric distribution which would give light of varying colour on the working plane. Separate lamps, of course, give the opportunity to choose the relative wattages of the two component light sources to suit the job in hand. Often the choice is for about equal light output from each type (e.g., 1,000 W of tungsten and 400 W of mercury) giving a white light with a red content approaching that of daylight (though not with such good colour-rendering owing to the colour distortion of the mercury component), but if a lower proportion of red is acceptable, a higher overall efficiency is obtained by using a larger proportion of mercury wattage.

The unity power factor of the tungsten component of a blended light system partially compensates for the low power factor of a mercury system without p.f. correction, and if the mercury wattage does not exceed 80 per cent of the tungsten wattage the overall p.f. will be about 0·85 or better.

The alternative method of colour correction—by the use of fluorescent powder

* Manager, Lighting Service Bureau.

on the inside of the outer bulb of a mercury lamp (type MBF)—has not been much used in the past as the early powders available gave only small colour improvement, in some cases accompanied by a slight loss in luminous efficiency. The powders now being used, however, mark a very real advance particularly in the colour-rendering of reds and blues, with no loss of luminous efficiency, and there may soon be many more installations of this type of lamp in use.

While on the subject of colour it may be worth mentioning that though the "daylight" fluorescent lamp is, in industry, the most widely used of the "whites" and is doubtless quite suitable in the great majority of cases, there still seems to be widespread ignorance of the fact that other colours are available and may be more satisfactory for operations requiring judgment of colour. The "natural" lamp is not so familiar as it should be to industrialists, and though the "colour-matching" lamp has been on the market nearly as long its particular advantages seem to be quite unknown to many for whom it would be the ideal lamp.

Recent reductions in the price and the improved performance and longer life of fluorescent lamps have had an appreciable result on the relative economics of the various lamp types. In the early years of fluorescent lighting they were welcomed by industry almost solely on account of the quality of light they gave, for they could seldom if ever be shown to be an economic proposition, in the narrow meaning of the gross annual cost of the installation. The position at present, however, appears to be that in a normal factory where the size of the individual lamps is chosen so that their light output suits the available mounting height, there may be little gross economic advantage in using any one of the three most common light sources as compared with any of the others. General statements of the above nature are always capable of being disproved in particular

Lamp Type	Mounting Height	Annual Gross Cost
300 W tungsten 1×80 W fluorescent	say 12ft	£48 £44
500 W tungsten 250 W mercury 2×80 W fluorescent	say 15ft	£38 £36 £40
1,000 W tungsten 400 W mercury	say 24ft	£32 £30
1,000 W mercury ..	say 40ft	£17

Comparative annual costs of systems

An installation of over 12,000ft of lighting trunking accommodating wiring and all gear for nearly 1,000 fluorescent lamps and also wiring for loudspeakers, internal telephones, fire alarms and sewing machine group motor drives

Illustrating the beneficial effects of wall surface treatment

instances, but usually the gross annual cost of providing 20 lm/sq ft illumination over 1,000 sq ft of floor space, with electricity at an average cost of 2d/kWh, 900 hours' use of the lighting per annum and the capital cost of the installation amortised over ten years, is likely to be roughly as shown in the table on the preceding page.

A greater average current cost than 2d/kWh or a more extended use than 900 hours per annum would, of course, give additional economic advantage in each case to the lamp having the highest efficiency, i.e., in this case, fluorescent.

Sodium lamps are omitted from the above comparisons because their major industrial use is for lighting exterior loading bays, yards, etc., for which different types of fitting will be required and a lower illumination level is probably adequate. There appears to be a tendency to light large exterior areas from a relatively small number of poles from 40 to 60ft high.

In the example above an illumination level of 20 lm/sq ft was chosen because it is about the upper practical limit for tungsten lamps in industrial reflectors if a reasonable degree of comfort is to be ensured. Fluorescent lamps offer greater opportunity of avoiding discomfort, and illumination levels will naturally tend to rise as greater knowledge of what causes discomfort is acquired and installations are planned to avoid it. Already values of 50 lm/sq ft are not uncommon.

Although there has been no outstanding advance, it is evident that more and more attention is being given to the use of suitable decorations or other devices to improve seeing conditions locally and working conditions throughout the factory interior. A number of operations require mainly a profile view of the component being handled, and a well-illuminated or luminous background against which to view the object is the best way of obtaining this effect. It is not unusual, for instance, to find temporary or permanent light-coloured screens erected behind a bench where work such as the setting of contact gaps is carried out, or perhaps an adjacent wall may serve the same purpose.

General structural decorations are also becoming lighter in colour, and in this respect the experience of one factory may have some significance for the future. Here one bay was repainted with near-white predominantly matt paint, and could be compared with other bays with existing light-coloured metallic paint, not new but reasonably clean. The illustration shows the remarkably different effect produced from a particular viewpoint, the darkness of the roof on the left probably being mainly due to the light-obstructing properties of the metallic paint used.

Office Lighting

Obtaining Adequacy Without Discomfort

By R. L. C. TATE, F.R.S.A.*

IN business offices, just as much as at the factory bench, good lighting is essential if eye-strain is to be reduced and a high standard of work maintained. Many of the visual tasks performed by clerical workers are of considerable difficulty and complexity, and very few are of so repetitive a nature that it is possible for visual attention to be relaxed once a cycle of manual operations has been mastered, as is often the case in factories.

Although much attention has been paid by architects to the provision of natural daylight, there are few offices in multi-storey blocks in which daylight levels of illumination are adequate in every part of the room even in the summer months, let alone in winter. If offices are to be adequately lighted, therefore, supplementary artificial lighting must be provided, a point which is emphasized in the recent Government report on lighting for clerical workers.† After discussing various methods of improving the daylighting of existing buildings, the Report says:—

> "Finally, the most advantageous course is to use artificial lighting to supplement the inadequate daylight. . . . We have described ways of extending the useful zone of office work by the use of carefully designed artificial light sources. This is also a useful and practicable method of improving the illumination of poorly daylighted existing offices and a far more certain and comfortable expedient than the use of external reflectors and other devices."

What is an adequate illumination value for clerical work? An average illumination of 20 lumens/sq ft is recommended for

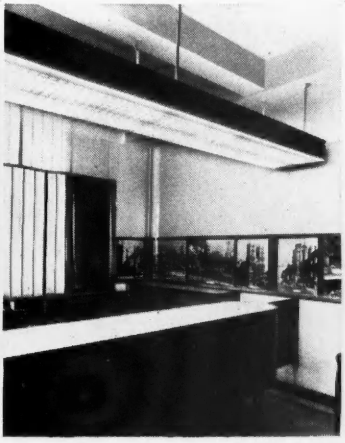
* Lighting Service Bureau.

† Post War Building Studies No. 30, "The Lighting of Office Buildings," H.M.S.O., 1952, p. 31.

Left: **The telephone switchboard operator in a large firm has a difficult seeing task. Here fluorescent lamps provide excellent shadow-free lighting without glare**

Centre: **This reception desk in a publisher's office owes much of its dignity to the striking louvred fluorescent fitting above it**

Right: **Good lighting on the filing drawers and adjacent tables is a necessity where data must always be up-to-date and readily available**



general offices and for typing, book-keeping and filing, and 15 lm/sq ft for private offices. An illumination of 30 lm/sq ft is recommended on the boards in drawing offices, but in practice this value is often exceeded. The reason why a lower lighting value is recommended for private offices is that the visual task is seldom so trying or so sustained here as in the general office or filing rooms. Not only does the executive normally see only the top copies of letters and documents, while the clerk has to try to decipher smudgy carbons where the contrast between letters and paper is much reduced, but he seldom uses his eyes for long periods at a time. Telephone conversations, interviews and other interruptions serve to rest his eyes at fairly frequent intervals.

If an average of 20 lm/sq ft is to be maintained, a minimum of 14 lm/sq ft must be provided, assuming a uniformity factor of 70 per cent. In an investigation made by the Department of Scientific and Industrial Research* on the lighting levels provided for 682 office workers, it was found that 58 per cent were working in less than 14 lm/sq ft and only 24 per cent were enjoying 20 lm/sq ft or more. Clearly there is much room for improvement.

Of course, an improvement in illumination values alone will not necessarily produce a completely satisfactory lighting scheme. Some handicaps, such as reflected glare and glitter from white glossy paper and typewriter and from comptometer keys, are rather more prominent than they are in some other lighting fields, and in the larger type of general office cumulative glare from the lighting fittings may be a problem, but the first necessity is to provide enough light and for this reason the use of fluorescent lamps in offices is becoming very general. Unfortunately many of the early installations consisted of bare lamps mounted directly on the ceiling, a method which gives rise to glare and frequently results in inadequate illumination at the working plane, although bare lamps give an impression of brightness in the room. Most of the complaints of eye-strain under fluorescent lighting come from people working in rooms lighted in this manner.

The problem of reflected glare or glitter from typewriter and comptometer keys is commonly found in offices. In the former case it is likely to be irritating or annoying rather than a positive hindrance to operation of the machine, for the majority of typists work by sense of touch, and it is more important to provide sufficient illumination on the notebook or copy than to avoid glitter on the keys themselves. Still, a small annoyance of this kind is likely to assume quite large proportions towards the end of the day, or when the operator is feeling "off colour," and its removal will do much to facilitate smooth running and thus improve efficiency. Comptometer operators have to study the keys very much more closely and reflections of light sources in them may prove a serious hindrance. Such reflections can make it very hard to read pencilled notes too, as the light is reflected in the graphite at certain angles, so that invoicing clerks may suffer from similar disadvantages.

This reflected glitter is always the result

A director's office in Paris where a most impressive louvred fluorescent fitting dominates the room

* Post War Building Studies No. 30, p. 53, Table 35.

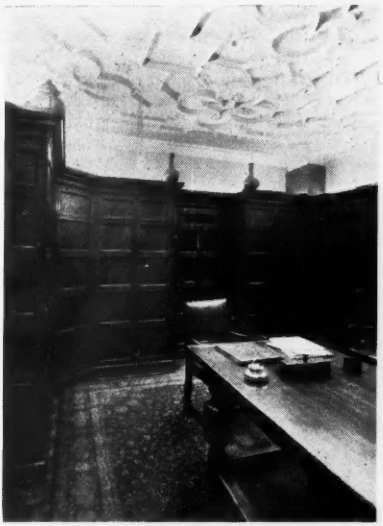
of the light striking the surface looked at at such an angle that it is partially mirrored in it, and reflected in the observer's eyes. It normally occurs when the light source is mounted beyond the object of regard. Wherever practicable, fittings illuminating such machines should be placed above or behind the operative's head, but so arranged that his body does not cast a heavy shadow on the work. If it is impossible to arrange the typewriters or comptometers in such a position, the only alternatives are to use a very large light-source of low brightness (such as a laylight or an area of indirect lighting) over the position concerned, or to provide a matt surface to the keys to avoid specular reflections.

For the same reason, the use of polished or glass desk tops, which mirror the lighting equipment, is strongly deprecated, and it is recommended that all office desks be covered with a matt light-coloured material such as lino, cork or rubber.

The problem of direct glare from lighting fittings is more often found in large offices than small ones. This is because in a large office the ceiling takes up a far greater proportion of the visual field and consequently distant lighting fittings will probably appear unpleasantly bright. In a small office, lighting fittings are more directly overhead, and therefore are less obtrusive. For this reason fittings which are quite satisfactory in a small office may be intolerably bright in a large one, where great care must be taken to reduce glare as much as possible.

Viewed nearly end-on a fluorescent fitting is almost invariably less bright and appears foreshortened, so that its glare effect is much less than when it is mounted at right-angles to the observer. If fittings *must* be viewed from the side the lamps should preferably be screened by an opaque or semi-opaque material.

The provision of " louverall " ceilings in large offices is not generally recommended. Although by this means, direct glare from lamps or fittings is eliminated, the complete lack of screening from directly below may give rise to images of the light sources appearing in specular or semi-specular surfaces. Louvred pendant fittings which allow some upward emission of light are, however, quite satisfactory, since they are normally more widely spaced than are lamps above an egg-crated ceiling and reflections are more easily avoided.



Indirect lighting from behind the cornice preserves the distinguished appearance of this director's office

Filing cabinets and library shelves present a special lighting problem, especially where they are arranged in tall stacks facing each other across a narrow gangway. It is almost always necessary to obtain as much light as possible on the vertical surfaces of card indexes or the backs of books, and it is recommended that fluorescent lamps be used, mounted at or near the tops of the stacks and lighting across the gangways. Here again, painting the stacks a light colour, instead of the almost universal olive green, will assist the penetration of the light to the lower shelves.

Drawing and tracing offices are among the most difficult types of room to light, partly on account of the rigorous seeing tasks in them and partly because of the idiosyncrasies of individual draughtsmen. The perception of fine lines drawn with a hard pencil demands a high level of illumination, and it is quite common to find values well in excess of the recommended 30 lm/sq ft. While architectural draughtsmen invariably use a board resting flat on a table, or only slightly inclined, engineers frequently have their boards mounted vertically, a much more difficult arrangement from the point of view of lighting.

A high level of general lighting is always to be desired, but this may have to be supplemented by individual lighting from adjustable fittings especially where vertical mounting of the boards is favoured. Shadows from the edges of set-squares and other drawing instruments can be a serious drawback, and where it is felt that the somewhat unusual appearance is unimportant, mounting the fittings in diagonal rows may prove a satisfactory solution to this problem.

Stroboscopic flicker from fluorescent lamps on a single-phase supply is likely to be especially noticeable in commercial art studios, as pencils are moved rather more rapidly for shading or freehand drawing than in engineering drawing, and this may cause sufficient irritation and annoyance to make the provision of a twin-lamp or multi-phase installation necessary. Tracing requires a very good light indeed, and is, moreover, often carried out by less skilled operatives. The use of a luminous panel on which the tracing is stretched, has proved effective, but care must be taken to screen off the uncovered parts of the panel to avoid glare.

The Report previously quoted, and indeed a little intelligent observation on one's own, will soon show convincingly that there is enough room for improvement in the general standard of office lighting to provide installation engineers with work for a considerable number of years to come, and to add a subtantial load to the supply system.

Electricity Sales in August

THE accompanying table shows the amount of electricity sent out by the Area Boards for their consumers during August. The national figures show an increase over August, 1952, of 9·1 per cent, but when corrected for weather and the number of effective working days the increase is 9·3 per cent. The weather conditions were warmer and there were more effective working days than in the corresponding month last year.

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for August			Totals for Twelve Months Ended 31st August		
	1952 Mill. kWh	1953 Mill. kWh	Increase or Decrease %	1952 Mill. kWh	1953 Mill. kWh	Increase or Decrease %
London	319·4	335·9	+ 5·2	5,214·7	5,699·1	+ 9·3
South Eastern	197·2	214·5	+ 8·8	3,009·8	3,322·6	+10·4
Southern	231·6	255·1	+10·1	3,485·4	3,887·1	+11·5
South Western	117·2	128·4	+ 9·6	1,688·4	1,867·6	+10·6
Eastern	321·7	350·8	+ 9·0	4,877·1	5,394·8	+10·6
East Midlands*	278·0	301·5	+ 8·5	4,201·9	4,600·1	+ 9·5
Midlands*	353·3	378·4	+ 7·1	5,752·4	6,108·6	+ 6·2
South Wales*	225·7	248·6	+10·1	3,213·7	3,353·1	+ 4·3
Merseyside and N. Wales*	225·6	244·1	+ 8·2	3,375·3	3,404·6	+ 0·9
Yorkshire*	377·3	397·4	+ 5·3	5,548·5	5,964·5	+ 7·5
North Eastern*	236·2	255·1	+ 8·0	3,467·7	3,585·4	+ 3·4
North Western*	414·0	471·7	+13·9	6,311·4	6,586·7	+ 4·4
South East Scotland	84·4	90·9	+ 7·7	1,194·1	1,270·8	+ 6·4
South West Scotland*	191·9	210·8	+ 9·8	2,876·5	3,077·2	+ 7·0
Total all Area Boards	3,573·5	3,883·2	+ 8·7	54,216·9	58,122·2	+ 7·2
Direct Supplies by Central Authority	60·7	83·2	+37·1	714·6	877·3	+22·8
Grand Total	3,634·2	3,966·4	+ 9·1	54,931·5	58,999·5	+ 7·4
Mainly Industrial Areas marked*	2,302·0	2,507·6	+ 8·9	34,747·4	36,680·2	+ 5·6
Mainly Non-Industrial Areas	1,271·5	1,375·6	+ 8·2	19,469·5	21,442·0	+10·1
Total Number of Effective Working Days	27·23	27·41				

* Over half the total sales by these Boards in the preceding financial year were to industrial consumers.

I.E.E. Centre Chairmen

Officers for the 1953–54 *Session*

IN our last issue we published the portraits and biographical notes of the chairmen of the specialized Sections of the Institution of Electrical Engineers. We now give brief notes of the men who will preside over the activities of some of the provincial Centres, and propose to deal similarly with the remaining Centre chairmen in our next issue.

Mr. H. West

Mr. T. Coates

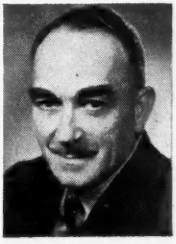
MR. H. WEST, M.I.Mech.E. (North-Western Centre), is chief electrical engineer of the Metropolitan-Vickers Electrical Co., Ltd. He was one of the earliest apprentices at Trafford Park to be awarded a company's scholarship, which took him to the Manchester College of Technology where he studied electrical machine design under Professor Miles Walker. After a short period in the Research Department he joined the Motor Engineering Department, for which he had been specially selected to undertake development work, and he eventually became chief engineer of the Motor and Welding Departments. Since 1935 he has served on a large number of committees of the British Standards Institution, Electrical Research Association, and British Welding Research Association, and has travelled extensively on behalf of M-V in Europe and America studying foreign designs of electrical apparatus. He has been chief electrical engineer and director since August, 1951.

MR. T. COATES, M.Eng., M.I.Mech.E. (Mersey and North Wales Centre), is manager of No. 3 Sub-Area and sub-area liaison officer of the Merseyside and North Wales Electricity Board. He was educated at Oundle and Liverpool University, and served a college apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd. In 1934 he joined the Liverpool Corporation Electricity Department as technical engineer, becoming chief technical assistant two years later. At the outbreak of the last war Mr. Coates joined the Royal Navy (Air Branch) as a pilot, and commanded an air squadron for two years before being recalled to Liverpool to resume his work there. He was appointed deputy city electrical engineer in 1945 and held this position at vesting date.

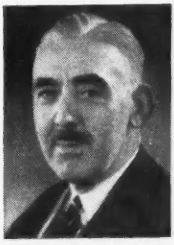
MR. G. CATON (North Midland Centre), is managing director of the Yorkshire Switchgear & Engineering Co., Ltd., and a director and founder of the Electro Mechanical Manufacturing Co., Ltd., Scarborough. He received the greater part of his technical education at the Royal Technical College, Salford, of which he is an associate, and his early training with Whipp & Bourne Ltd., and the Harland Engineering Co., Ltd. He later became chief engineer of the Switchgear Department of the latter company. In 1936 he was appointed to a similar position with the

Mr. G. Caton

Mr. H. J. Gibson



Mr. H. Esther



Brush Electrical Engineering Co., Ltd., and commenced his association with his present organization in 1939. He is the patentee of IVIO metalclad switchgear produced by his present company. Mr. Caton is vice-chairman of the Switchgear Section of B.E.A.M.A., and a member of the Switchgear Technical Committee and the Joint B.E.A./B.E.A.M.A. Committee on Switchgear Standardization.

MR. H. J. GIBSON, B.Sc. (Hons.), A.C.G.I. (South Midland Centre), has been chief commercial officer of the Midlands Electricity Board since nationalization. He served an electrical apprenticeship in H.M. Dockyard, Sheerness, and, after service in the Royal Tank Corps in the 1914–18 war, continued his studies at the City and Guilds Engineering College. In 1923 he was appointed assistant electrical engineer to the British Electrical Federation, and in 1930 he commenced his association with the Shropshire, Worcestershire and Staffordshire Electric Power Co., which continued until vesting date in 1948. During this period he held the successive appointments as assistant engineer, Distribution Department (1930–35), deputy distribution engineer (1936–40), manager of the company's Central Division (1940–45), and commercial manager (1946–48). He is an associate member of the American Institute of Electrical Engineers.

MR. H. ESTHER, B.Eng. (North-Eastern Centre), is head of the operation and maintenance section in the Chief Engineer's Department of the North Eastern Electricity Board. He was educated at Waterloo-with-Seaforth School and received his engineering education at Liverpool University. In 1923 he joined the North-Eastern Electric Supply Co. as a student engineer. After holding various positions with the company, he was appointed engineer, Operation Department (Transmission and Distribution) in 1947, which appointment he held until taking up his present position in 1948.

NEXT WEEK'S EVENTS

Monday, 28th September

BOURNEMOUTH.—Grand Hotel, Firvale Road, 8.15 p.m. A.S.E.E. Bournemouth Branch. "Diagnosis of Faults in Fluorescent Lighting Circuits," by Mr. Mitchell.

LEEDS.—Leeds University, 7.30 p.m. Incorporated Plant Engineers, West and East Yorks Branch. "Recent Developments in Pre-stressed Concrete," by Dr. R. H. Evans.

Priestley Hall, City Square, 7.30 p.m. I.E.S. Leeds Centre. Public lecture, "Stage Lighting," by P. Corry.

LONDON.—Caxton Hall, S.W.1, 7 p.m. E.P.E.A. London Technical Group. "Earthing," by P. W. Cave.

Wednesday, 30th September

LONDON.—London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, London Section. "The Impact of Communication Theory on Television," by Dr. D. A. Bell.

Wednesday, 30th September, to Wednesday, 7th October

NETHERLANDS.—Iron and Steel Institute. Special meeting.

Thursday, 1st October

CARDIFF.—South Wales E.B., The Hayes, 5.45 p.m. I.E.S. Cardiff Centre. "Electric Discharge Lamps for Plant Irradiation," by J. J. French.

CROYDON.—Café Royal, North End, 8 p.m. A.S.E.E. South London Branch. "Electrical Heat Treatment" (film).

GLASGOW.—At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, 6.30 p.m. I.E.S. Glasgow Centre. "Blended Light," by S. Anderson.

MANCHESTER.—College of Technology, 7.15 p.m. British Institution of Radio Engineers, North-Western Section. "The Detection and Cure of Parasitic Oscillations in Radio and Electronic Equipment," by H. Whalley.

NOTTINGHAM.—Police Assembly Hall, Shakespeare Street, 6 p.m. I.E.S. Nottingham Centre. Chairman's Address, by N. C. Slater.

PETERBOROUGH.—Dujon Café, Market Place. Incorporated Plant Engineers, Peterborough Branch. Ladies' Evening.

SPALDING.—Masonic Hall, Pinchbeck Street, 7.30 p.m. I.E.E. East Midland Centre. Discussion on "Overhead Distribution," opened by H. W. Grimmitt and R. F. Proctor.

Thursday, 1st October, to Saturday, 10th October

LONDON.—Olympia. International Handicrafts, Homecrafts and Hobbies Exhibition.

Friday, 2nd October

BIRMINGHAM.—"Regent House," St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. Chairman's Address, by Howard Long.

LIVERPOOL.—At the Liverpool Engineering Society, 9, The Temple, Dale Street, 7.30 p.m. A.S.E.E. Liverpool Branch. "B.S.S. 7 : 1953. The New Rubber and Plastic Cables, their Meaning and Use," by J. R. Cox.

LONDON.—Café Royal, Regent Street, W.1, 7 p.m. to 2 a.m. Electrical Trades' Commercial Travellers' Association. Annual dinner-dance.

Waldorf Hotel, Aldwych, W.C.2, 7 p.m. Institution of Works Managers. Annual general meeting and film show.

Townsend House, S.W.1, 7 p.m. Junior Institution of Engineers. Film evening.

MANCHESTER.—Engineers' Club, Albert Square, 6.30 p.m. Manchester Association of Engineers. Presidential Address by Prof. H. Wright Baker.

STONE.—Duncan Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. Chairman's Address, by Col. C. F. Calveley.

VIEWS on the NEWS

By REFLECTOR

LAST week I mentioned a letter in the *Financial Times* from a reader who had received a complicated account from the South Eastern Electricity Board which boiled down to a charge of one penny. Mr. A. L. Burnell, the Board's secretary, has replied. He says that accounts for 1d are not generally sent by his Board; the account seems to have slipped through among the five million accounts which the Board sends out annually. I am still wondering, though, what the customer had for his penny.

* * *

Writing to the *News Chronicle*, presumably on the question of the prevention of "smog," a correspondent from Buxton says:

> "There must be thousands of people who would gladly exchange their open fires for gas or electric but for the fact that coal is so much cheaper. Let the gas and electricity boards bring down the price (it could easily be done by strict economies on the administrative side) and we'll change over most willingly."

While questioning whether sufficient savings could be made in administrative costs to result in an appreciable lowering of charges, it can be pointed out that, with coal costing what it does, it is even now, for periods up to six hours or so, cheaper to use electricity; and there is no indication that the price of coal will ever go down.

* * *

No doubt the five-day week is a good thing, provided it does not mean the neglect of essential work. There are some services which must be maintained for seven days a week and electricity is one of them. I believe that most Electricity Boards have arrangements for ensuring that consumers' emergency week-end calls are attended to, but I have recently seen a number of newspaper complaints that people have been told (sometimes even on a Friday) by the local offices that they must wait until Monday before a man can call to remedy a fault. Of course there are unreasonable people who want immediate attention to trivial matters but, as a rule, the troubles are such things as cooker breakdowns which are really inconvenient where no alternative methods of cooking exist.

* * *

Many of us have no doubt experienced a slight electric shock on boarding a bus and leakage currents occasionally cause discomfort to animals and sometimes human beings. Something on a bigger scale is reported from Sicily, where villagers on rocky Mount Pellegrine were all said to be attacked by "pins and needles" when a storm electrified the rock. They had, it is said, to insulate themselves by sitting on their beds.

* * *

In protesting against increases in electricity charges for retail establishments a member of the Derby Chamber of Trade said that he did not believe that the East Midlands Board had "done this off their own bat." He blamed the Central Electricity Board. I am sure that the East Midlands Board would not try to shelter behind a defunct body, however attractive the idea might seem.

* * *

"Beachcomber" of the *Daily Express* has got hold of something. He says:—

> "It is good news for all that by installing a thing called a load-limiter in a house the electricity authorities could cut off all electricity whenever they pleased, without warning. It ought to be possible to mine all houses, so that they could be blown up at a moment's notice if they interfered with town or country planning. People, that is to say, units of unofficial personnel, are such a nuisance."

He might be told that desperate diseases demand desperate remedies—or that with load limiters people cut themselves off.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Belfast Electricity Committee has recommended **Mr. R. P. Watson,** who has been acting city electrical engineer of Belfast for about a year, for confirmation in that position. The recommendation is to go before the City Council on 1st October.

Mr. A. H. F. Linton, D.F.H., A.M.I.E.E., engineering inspector with the Ministry of Fuel and Power, has been appointed deputy chief engineering inspector, in succession to **Mr. H. W. Grimmitt,** M.I.E.E., A.M.I.Mech.E., who, as we recently reported, has been promoted to be chief engineering inspector. Mr. Linton was educated at Cheltenham College and Faraday House, and from 1932-37 held positions with Johnson & Phillips, Ltd., the Westmorland Electric Supply Co. and the Peterborough Corporation. In 1937 he joined the engineering staff of the Electricity Commission. During the war he joined the R.N.V.R. as an electrical lieut.-commander, and was engaged on degaussing work. He returned to the Commission after the war and transferred to the Ministry of Fuel and Power in 1948.

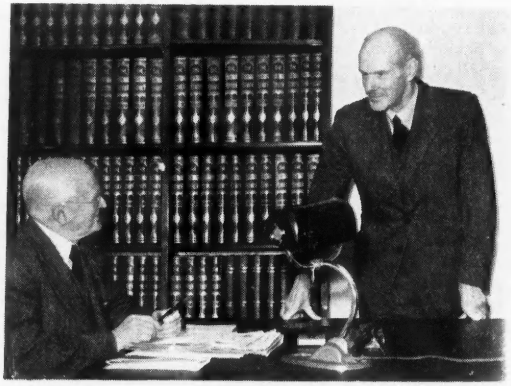
Mr. A. H. F. Linton

Mr. H. W. Swann, O.B.E., M.I.E.E., whose retirement from the position of Senior Electrical Inspector of Factories is announced, is one of the best-known men in the industry by reason of his activities in a number of spheres, particularly since he has held his present position for twenty-three years. Mr. Swann was born in 1883 at Cambridge. After attending the Perse School he went to Faraday House and later had works experience. He then served with the Metropolitan Electric Tramways and the North Metropolitan Electric Power Co. for some time. In 1922 he joined the Home Office Factory Inspectorate under Mr. G. Scott Ram and when the latter retired in 1930 Mr. Swann was appointed Senior Electrical Inspector.

During his period in this position, apart from his interesting annual reports, Mr. Swann has for many years dealt with domestic electrical accidents (he has been a member of the Interdepartmental Committee on Safety in the Home) and there is no doubt that his activities in this direction have had much influence in reducing the number of such accidents. He has also interested himself in the applications of electricity in surgery and medicine on behalf of the Ministry of Health, and in 1938 he contributed a valuable article on electricity regulations in connection with the use of anæsthetics to the *British Medical Journal*. Electricity in cinemas is another subject in which he has acted as adviser to his Department, and he also advised the Home Office Fire Inspectorate. He became an O.B.E. in 1947.

He has been particularly interested in the Association of Supervising Electrical Engineers and served as president of that body from 1939 to 1944. He has also been a member of the I.E.E. Council and the General Council of the B.S.I., and has served on a number of committees of both Institutions. In 1948 he

Mr. H. W. Swann (seated), with Mr. F. H. Mann who succeeds him as Senior Electrical Inspector of Factories



was a member of the British delegation to a conference on safety regulations in factories organized in Geneva by the International Labour Office.

Although retiring Mr. Swann will not, we hope, sever his connections with the industry to which his experience has been of such great value.

Mr. F. H. Mann, M.I.E.E., at present Deputy Senior Electrical Inspector, is to succeed Mr. Swann. Mr. Mann was born in 1890. He was educated at Birmingham University and received his training with the British Thomson-Houston Co., Ltd., at Rugby. He served for some time as chief assistant with Messrs. Moffett, Rosser & Mann, the Birmingham consultants, and then during the 1914-18 war was with the R.N.D. Engineers (Dardanelles) and the R.N.V.R. (lieut. in battle cruiser force).

After a period as chief constructional engineer in the Grimsby Electricity Department he returned to Moffett, Rosser & Mann as a partner in 1921. Ten years later he was appointed H.M. Electrical Inspector of Factories for Scotland, becoming inspector for the Midlands in 1935. In 1942 he joined Mr. Swann as his deputy. In his new capacity he will act as electrical adviser to the Home Office. Among other contributions on electrical subjects, Mr. Mann was responsible, with Mr. Fordham Cooper, for the I.E.E. paper on "Industrial Fire Risks." He is a member of a number of I.E.E., E.R.A. and B.S.I. Committees and the B.S. on Intrinsic Safety and several Codes of Practice were prepared under his chairmanship.

Mr. E. L. Wildy, A.M.I.C.E., A.M.I.Mech.E., has been appointed managing director of the London Electric Wire Co. & Smiths, Ltd. In addition the following four executive officers have been appointed directors of the company:—**Mr. F. W. Freeman** (chief accountant), **Mr. G. E. Jewell, Mr. S. B. Klein** (general manager of the Leyton works) and **Mr. G. W. Child** (general manager of the Salford and Trafford Park works). As we have already reported **Mr. A. N. Smith** has succeeded the late Mr. W. J. Terry as chairman of the company.

Mr. L. E. Mold, who has been a director of C. A. Parsons & Co., Ltd., for the past fifteen years, has resigned from the board owing to ill-health.

Mr. G. Morrison, London representative of Universal Boilers & Engineering Co., Ltd., who underwent operations earlier this year, has now made a complete recovery and is resuming his duties on 1st October. His address is 36, St. James' Mansions, West End Lane, London, N.W.6.

Mr. G. L. Mason, A.M.I.E.E., second assistant engineer in the system control room at Thornhill of the Yorkshire Electricity Board, has been appointed senior assistant engineer (operation) in the No. 3 (Sheffield) Sub-Area of the Board. Mr. Mason was educated at Heriot Watt College, Edinburgh, and before nationalization had had experience with the Lothians Electric Power Co., the Electricity Board for North Ireland and the Yorkshire Electric Power Co.

Mr. Arthur Upton, Associate I.E.E., has returned to this country from the United States and is resuming his position as manager of the Switchgear Department of Johnson & Phillips, Ltd., Victoria Works, Charlton, S.E.7, on 1st October.

Mr. Thomas Marsden, technical assistant in the Transport Department of Derby Corporation, has been appointed works superintendent with the South Shields Corporation transport undertaking. He succeeds **Mr. D. Mather** who has resigned.

Mr. John Elliott, chairman of the Railway Executive (which ceases to exist at the end of this month), has been appointed chairman of the London Transport Executive in succession to Lord Latham. When the railways were nationalized Mr. Elliott was acting general manager of the Southern Railway.

An unusual kind of entertainment was staged on Tuesday and Wednesday of last week at the Cripplegate Theatre, London, E.C.1, by the **Portland Players** (British Electricity Authority). It took the form of a "lecture" on the development of the drama from prehistoric to modern times, illustrated by burlesques of Greek, Shakespearean and twentieth-century plays. With the unrelated title, "Across North Africa with a Pelican," the script was by Derek Haken, Michael Astrop, Philip Walton and Jack Haken. Clifford Coffee was the very capable and amusing "lecturer" and he had the services of a much larger cast than usual. The producer was John Cresswell.

A large audience saw the annual swimming gala presented by the Northmet Sub-Area of the **Eastern Electricity Board** at Wood Green Baths on 18th September. There was a very varied programme and one of the main attractions was a display of trick and fancy diving by the Highgate Diving Club.

OBITUARY

Mr. H. J. Hodges.—W. T. Henley's Telegraph Works Co., Ltd., announces the death of Mr. H. J. Hodges on 10th September. Mr. Hodges commenced his service with Henley's at the Woolwich Works in 1897, and attained the position of assistant works manager in 1939. In 1943 he was appointed chief labour officer. He retired from that position at the end of 1949, and had

since been retained in a consultative capacity. From 1937 Mr. Hodges served on the National Joint Industrial Council for the Electric Cable Making Industry and was for six years chairman of the employers' side.

Mr. Percy Butler, B.Sc., M.I.E.E., director and joint general manager of Bruce Peebles & Co., Ltd., died at his home in Edinburgh on 21st September. Mr. Butler was born at Normanton in 1896, and after education at the local Grammar School and Leeds University College, served an apprenticeship with the Metropolitan-Vickers Electrical Co. Subsequently he worked as a transformer designer with that company. He joined Bruce Peebles & Co. in 1926 and became chief transformer designer, ultimately being appointed, in 1943, manager of the Transformer and Rectifier Departments. He was made joint general manager (with Mr. W. B. Laing) in 1951 and was elected to the board of the company in 1952.

The late Mr. P. Butler

Mr. Butler had written a number of papers on transformer subjects and in 1940 he installed what was then the largest scheme for combined voltage and phase angle control in the country. In 1951 he gave a number of lectures to public and industrial authorities in Canada.

He was chairman of the Scottish Centre of the I.E.E. for 1951-52.

Mr. J. T. Warburton, who died suddenly at his home at Blundellsands, Liverpool, on 17th September, had been connected with the shipping industry for many years and since joining the British Thomson-Houston Company in 1931 had looked after the supply of lamp and lighting equipment to the Admiralty and Mercantile Marine. He was sixty-eight.

WILLS

Mr. R. A. Deans, manager of the Special Lamp Department of the British Thomson-Houston Company, who died on 30th May last, left £6,433 gross (£4,901 net).

Mr. T. Halse, B.A., A.M.I.E.E., research superintendent of Permali, Ltd., who died on 17th May last, left £6,359 gross (£4,598 net).

I.E.E. Benevolent Fund

THE annual report of the Court of Governors of the Incorporated Benevolent Fund of the Institution of Electrical Engineers shows that the capital at 30th June last had appreciated by £3,032 to £132,103, of which £15,673 was in respect of the " Chesters " Trust (Homes Fund). Income declined by £1,396 to £14,477 including £459 received for the " Chesters " Trust. There were 10,264 subscriptions and donations to the General Fund, which brought in £12,155, compared with £11,245 in the previous year. Expenditure decreased last year and only exceeded the income from subscriptions by £278 as compared with a figure of £2,511 for the previous year. Grants aggregating £8,989 were made to 123 beneficiaries in assisting whom the Fund also gave support to ninety-eight dependants.

Subscribers also executed 1,650 deeds of covenant guaranteeing payment for a minimum period of seven years. This substantially increased the value of their donations as the Fund was thereby able to recover nearly £2,000 from the Inland Revenue Commissioners. In addition, 260 similar deeds have been signed in relation to the Homes Fund, which from its inception has received £32,248 in subscriptions and donations. Grants amounting to £130 were made from the Lord Hirst Fund during the year.

Anti-Submarine Equipment

THE first sonar or echo-ranging equipment to be manufactured in this country under the United States Off-Shore Procurement Programme was delivered to officials of the U.S. Navy in London last week, who then turned it over to a representative of the Norwegian Government.

The equipment, which is used in anti-submarine warfare, was made by R.C.A. Photophone, Ltd., London, under an off-shore procurement contract worth about $3½ million, which was placed in 1952 by the U.S. Navy Bureau of Ships, Washington, with the Radio Corporation of America. The contract is administered by the U.S. Navy Purchasing Office in London and most of the equipment is intended for use by navies of the North Atlantic Treaty Organization.

New Zealand Power Shortage

Steam Station Proposals

By JOHN CARDEW

IN spite of New Zealand's considerable post-war electric power development, supply has not been keeping pace with demand and an authoritative speaker has just caused a good deal of surprise and apprehension by declaring that "power shortages in the North Island will return before 1960 and will be more acute than in the past." He is Mr. C. J. Lovegrove, chairman of the Auckland Electric Power Board's Public Relations and Power Supply Sub-Committee and also president of the New Zealand Electric Power Supply Authorities' Association. He spoke on the basis of a report by the Auckland Board's chief engineer to the effect that the North Island system can only stand "certain percentage increases in loading over future years, even after allowing for the commissioning of further stations on the Waikato River."

Since April supply authorities have been paying an average of 50 per cent more for bulk power from the State under a new five-year contract agreed upon by the Government and the Electric Power Supply Authorities' Association. Consumer tariffs have as a result increased heavily and in the Auckland Province have risen by amounts varying from a quarter to a third. Government policy is based on supplying electricity at cost to the power boards. If the new scale of charges returns a profit to the State Hydro-Electric Department excess earnings will be given back to the consumers. If, on the other hand, the costs of producing power exceed the estimates, the public will have to make good the difference.

Proposed Sales Campaign

Revision of power prices up to the new level has been based on two factors—a period of sales at below cost under the old agreement and the higher costs of the power undertaking, which it is estimated will increase from £4·3 million in 1952–53 to £5·7 million in 1953–54 and £6·4 million in 1954–55. It is in fact not surprising that Mr. Lovegrove was prompted to suggest that the Auckland Board should conduct a sales promotion campaign with a view to improving the load factor.

Power Shortage Position

On the basis of statements made in recent years by the Minister in charge of the State Hydro-Electricity Department, Mr. Goosman, it is clear that Mr. Lovegrove was not exaggerating the position when he forecast even worse shortages than those of the post-war years. Although major hydro-electric stations have either come into operation or are scheduled for early completion, the overall picture is one of demand outstripping supply before a new generating unit is ready to make good the deficit. Added to this is the fact that the Government's programme is well behind schedule. Three years ago Mr. Goosman expressed the hope that restrictions would be ended in 1952 and indicated some of the steps that would have to be taken to safeguard the position beyond 1955. These included the completion of three hydro stations to come into operation respectively in 1954–55, 1955–56 and 1956–57. Two years later the Minister's annual report revealed that these dates had been abandoned and it is now evident that the whole programme is anything from a year to two years behind-hand. A decision on whether one station (originally due for completion in 1956–57) is to be designed in New Zealand or Great Britain has not yet been reached and although the necessity for orthodox steam stations has been accepted there has so far been no move towards their construction. (The initial suggestion is for a 100,000 kW station.)

The long-term hope for cheaper power in New Zealand and a final end to rationing is, of course, an expansion of generating resources. Hydro stations offer the best prospects for cutting costs, as was strikingly brought out by experience in 1951–52.

In that year hydro plants produced 3,040 million kWh at a generating cost of £326,484. During the same period the production of only 172 million kWh from State thermal stations cost £924,102.

It has to be remembered, however, that auxiliary sources of power in the Dominion are notoriously hampered by reliance on outdated plants and by inconvenient sitings. There is general agreement that a large and modern coal-burning plant established in the centre of a rich coalfield would considerably reduce the present discrepancy in prices between hydro and thermal power. So far, though, the Government has not been able to find a coalfield capable of supplying the required 350,000 tons of fuel a year for the purpose. Since at the present rate of growth of demand for power in New Zealand the total output must be doubled at least every seven and a half years, only very large steam plants could materially improve the situation.

Nevertheless the early establishment of a coal or other fuel-burning steam station is increasingly favoured by a number of supply authorities. It has been estimated that the cost of such a station has gone up three times since the idea was first put forward. The Canadian and Australian practice of establishing steam stations to help hydro-electric stations over the peak load and in emergencies is also being cited as a further argument in favour of a similar policy being adopted in New Zealand. The possibility of power transmission across Cook Strait is also being urged on the Government since the South Island's reserves of water power are much greater than those of the North Island.

Meanwhile high hopes continue that in due course power derived from geothermal steam will make a major contribution to a solution of the Dominion's continuing power shortage. Geothermal activity exists over a large area of the North Island. This area is wedge shaped, with the point lying just south of Lake Taupo and the broad end stretching north into the waters of Poverty Bay on the east coast. Drilling has so far been confined to about 13 square miles in one valley at Wairakei. One unofficial estimate is that from the areas already tested as much as 250,000 kW of power could be generated—that is, almost as much as from two Waikato River hydro-electric stations (Maraetai and Karapiro) combined.

At the moment there is certainty of 20,000 kW and boring operations are continuing. Work on the project began three years ago and from the outset the aim was power development. Last March the Prime Minister, Mr. Holland, revealed that discussions had been taking place between the New Zealand and British Governments concerning the possibility of utilizing geothermal steam for the production of "heavy water." So far there has been no official pronouncement on how this would affect use of the steam for power generation.

Transmission Line Design

A SURVEY of the characteristics of 280 transmission lines operated at from 100 to 340 kV and erected during the past ten years in the United States has been carried out by the *Electrical World* and tabulated in comprehensive statistical form. The particulars show 48 tower designs with steel structures and cross arms exclusively above 220 kV, though wood with wood cross arms is used largely up to 161 kV. Horizontal conductor formation is employed for about 70 per cent of the lines up to 250 kV, separation of phase wires ranging from 13·6ft for 115 kV to 30ft for 330 kV; for a vertical arrangement the average is from 11ft to 30ft. Above 230 kV single circuits are preferred. Middle conductors are offset (to provide for "galloping") on 60 per cent of vertical designs, the deviation reaching 5ft at 330 kV. Steel-cored aluminium, usually with protective anchoring at clamps, greatly predominates (partly attributable to scarcity of copper). Vibration dampers (mainly Stockbridge) are in use on nearly half the lines. Two earth wires are preferred to one in a 5 : 1 ratio and to none in a 15 : 1 ratio; they are of steel in 60 per cent, copperweld in 25 per cent and s.c.s. in 12 per cent of the total.

Basic impulse insulation level is from seven to nine times working voltage for wood constructions and four to six times for steel. For terminal apparatus the basic insulation level is about 60 per cent of that of the line voltage for wood and 90 per cent for steel, the margin decreasing with voltage. The neutral is solidly earthed in almost all instances.

Circuit breakers up to 200 kV use 5-cycle interruption; above that voltage 3 cycles is general. Instantaneous reclosure is applied on 20 per cent of the lines and 16 to 20 cycles is the commonest delay. Carrier current is used on over half the lines, generally with two frequencies between 30 and 150 kc/s. Only 7 per cent have microwave systems, the 1,860–1,940 and 6,800–7,100 Mc/s bands being most common.

Electrical Contracting Dispute

Court of Inquiry Proceedings

ON Thursday last week the members of the Electrical Trades Union employed in the electrical contracting industry who had been on strike for over a fortnight resumed work as the Court of Inquiry set up by the Minister of Labour began its proceedings in public at the Law Courts. The chairman is Mr. John Cameron, Q.C.

It was decided that Mr. W. C. Stevens, general secretary of the Union, should put his case first. He said that last year two increases of 2d an hour were granted by the employers but wages were still inadequate to meet the cost of living. Accordingly the Union, in March last, presented a claim for a "substantial increase." This was rejected by the employers on 10th June, whereupon the Union gave notice that unless an offer of a wage increase was received by 24th August "official" strikes would be called. Five weeks passed without any response from the employers, apart from a formal acknowledgment. There had been no suggestion of arbitration from either side.

Mr. Stevens had contended that having regard to the rise in the cost of living his London members were entitled to an increase of 3d an hour and provincial members one of 2½d. The National Federated Electrical Association had refused to make an interim offer and said that its members would have to be consulted.

Speaking for the N.F.E.A., Mr. H. J. Phillimore, Q.C., said that the Union had tried to force by strike action a claim which the Association had rejected because it was considered to be unjustified. He said that the Union dared not submit the claim to arbitration because it knew it was unjustified.

Mr. Phillimore asserted that the officials of the E.T.U. were determined to deal with the matter by strike action if they could; they did not really want to negotiate a settlement. The principal officers and all but two of the E.T.U. executive council were members of the Communist party. The stoppages had taken place at sites which were of importance to the defence programme or the national economy.

Mr. Stevens, replying to the chairman, said that the sites were not selected on account of their national importance but because they were of importance to the Union in its dispute.

Mr. Phillimore said that there was evidence that the men did not want the strikes. The Union did not call them out in the men's own interest but from a desire to disrupt the national economy and destroy the negotiating machinery.

On Friday there were further exchanges between Mr. Phillimore and Mr. Stevens regarding the motives for the choice of sites and Mr. Stevens averred that when the Union originally put in its claim it desired to settle the matter peaceably. The Union had always been anxious to preserve the negotiating machinery, and still was, but it objected to arbitration after employers had "strained the machinery."

Replying to Sir Graham Cunningham, a member of the Court, Mr. Stevens said that he could not commit the Union to arbitration but he, personally, would do his utmost to re-establish harmonious relations in the industry if the employers were willing. They would be willing to resume negotiations if the employers would make an interim offer. It was their desire to arrive at a compromise between a wages award forced on the employers by strike action and they (the Union) being forced to accept plain arbitration.

Giving evidence, Mr. L. C. Penwill, director and secretary of the N.F.E.A., said that on previous occasions his Association had had to suspend the negotiating machinery when it considered that the Union had broken the national working rules. He denied that the Association had deliberately "stalled" the Union's claim and said that he and his colleagues considered that the Union well knew what alternatives were available but deliberately chose to embark upon "guerrilla warfare." The N.F.E.A. had seriously considered arbitration but rejected it because they were of the opinion that the Union would not abide by any decision arrived at.

Upon the resumption of the hearing on Monday Mr. Penwill was asked by Mr. Stevens if he or members of his organization had tried to influence members of the Union to remove officials from office. Mr. Penwill denied this but agreed that on one occasion he had urged employers to suggest to their staffs that they should take an active part in the Union's affairs and so get rid of disruptive elements. He included Mr. Stevens and others in that category.

Mr. S. L. M. Barlow, president of the N.F.E.A., answering Mr. Phillimore, said that he attended a meeting on 12th August. If arbitration had been suggested at that stage the thing would have broken down entirely. His own company had a "token" strike in July. He thought that there was no justification for increased wages and that was the unanimous view of his Council.

After the luncheon break Mr. Stevens and Mr. Phillimore had separate private talks with the members of the Court.

Mr. Stevens said it was a pity that the N.F.E.A. had imputed political motives for the strikes. In his opinion the employers had acted on political considerations and on a desire to undermine the leadership of the E.T.U. They had used the inquiry for the purposes of a political " witch hunt."

In his final address, Mr. Phillimore said that the actions of the E.T.U. were completely inconsistent with its words. It was quite apparent that the work of the Joint Industrial Council was hampered by mutual distrust and maybe the airing of views of the two sides at that inquiry would assist to remove it.

The dispute could very well have been settled by arbitration, but it had been so conducted by the Union as to make peaceable settlement as difficult as possible.

The inquiry concluded on Monday afternoon and its chairman announced that the Court's findings would be published in due course.

* * *

Electricians employed by F. H. Wheeler (Sheffield), Ltd., on a development at the Appleby-Frodingham steelworks at Scunthorpe, Lincs, ceased work this week because the company declined to dismiss two foremen whom they alleged had " blacklegged " during a strike at the works, called by the Electrical Trades Union. Twenty-three of the 100 men went back on Monday morning, claiming that the stoppage was unofficial.

Oxford Street Traffic Signals

THE Siemens & General Railway Signal Co., Ltd., has been awarded a £26,000 contract for re-equipping Oxford Street, London, with a new system of automatic signals to replace those installed in 1930–31. The new system has been devised by the officers of the St. Marylebone Borough Council in co-operation with the company and will include equipment designed to make mechanical assessment of the traffic density and effect appropriate changes in the signal indications along the length of the street. This will mean that, except when traffic density is greatest it will eventually be possible for a vehicle to have uninterrupted passage from Marble Arch to St. Giles' Circus, a distance of about 1¼ miles, passing through seventeen intersections including Oxford Circus.

The contract includes the replacement of many of the existing signal heads and substitution of vehicle actuated equipment for fixed time controllers. A traffic integrator will be included in the new master controller and this device will modify cyclic changes in signal indications to accord with fluctuations in traffic density streams, and at the same time effect changes in the progressive pattern to facilitate movement of vehicles along the length of the street. Vehicle detectors will be installed in all side streets and at important intersections in the main roads with the object of reducing waiting periods at signals when the volume of traffic is light. The new system will be able to revert to fixed time cycle as conditions demand.

CORRESPONDENCE

Letters shoula bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Electricity for Transport

WE were given to understand that when electricity was nationalized it would benefit the country's economy, but we see no economic policy on the part of the British Electricity Authority.

Electricity is becoming plentiful and new power stations are being built, yet big transport customers are changing over to fuel oil because of the high cost of electricity. This loss can never be made up by domestic consumption.

The Notts and Derby Traction Co. (power station and trolley-bus system) was nationalized and its trolley-buses were transferred to the British Transport Commission, which last March sold the fleet and equipment and converted the routes to diesel-bus operation. Edinburgh, Liverpool and Sunderland Corporations are also changing over to buses. Southend has announced its intention of scrapping its trolley-buses.

The latest (and a very large consumer of electricity) is Leeds, whose Labour council has decided to scrap the trams as soon as possible despite the recent purchase of modern railcars.

Many transport concerns believe that fuel oil tax will become cheaper. This appears to be wishful thinking on the part of those who dislike electrical transport, but, nevertheless, electricity, though cheaper than imported fuel, is surely far too expensive.

It would therefore pay the B.E.A. to reduce its prices and thus widen the price gulf between electricity and imported oil. In this way it would hold its present large and useful customers and eventually add many more to them.

W. G. AKERMAN.

Stanmore, Middlesex.

Portable Insulation Test Set

An Alternative to the More Orthodox Instrument

By P. ASHER, A.M.I.E.E.*

THE instrument described in this article has been developed for measuring electrical insulation resistance over the range 0·3 to 3,000 MΩ. The measurements are indicated on an electro-magnetic cyclometer type counter, and the instrument, which is compact and portable, operates from the mains or dry batteries.

In its present form the instrument has three ranges, the unit of the counter being equivalent to 0·1, 1·0 or 10 MΩ according to the range selected. The accuracy is better than ± 2 per cent on measurements which record 100 or more units of resistance, dropping to ± 5 per cent on measurements recording 20 units of resistance. Below this the accuracy will be within one unit, which although not so high as in bridge methods is better than some commercial test sets, and is adequate for most industrial purposes. The voltage applied to the circuit under test does not exceed 110 V d.c.

If a capacitance C is charged through an unknown resistance R from a d.c. source E (see Fig. 1a), then the rise of voltage V across the condenser is given by an exponential curve (as shown in Fig. 1b) the equation to this curve being

$$V = E\,(1 - e^{-\frac{t}{RC}})$$

$$\text{or } \frac{V}{E} = 1 - e^{-\frac{t}{RC}}$$

From this it will be seen that the time for the voltage across the capacitor to build up to a given proportion of E is dependent on the product of R and C. As C is fixed, then for any given ratio of $\frac{V}{E}$ there is a particular value of ratio $\frac{t}{R}$ which satisfies the above equation. In other words, the time taken to reach the given voltage is directly proportional to the value of the resistance.

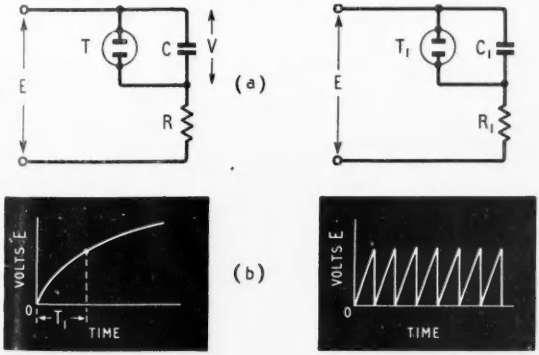
For instance, if $\frac{V}{E}$ has a value of 0·632, or $1 - \frac{1}{e}$, then t must equal the product RC.

The value of C can be chosen so that it is charged through a resistance of one megohm to a voltage of 0·632E in one second. If then the 1 MΩ resistor is replaced by any resistor of unknown value, the time in seconds for the capacitor voltage to reach 0·632E will be a measure of the unknown resistance.

This measurement is independent of the value of E; also it is not essential that a ratio of V to E of 0·632 must be chosen because any other ratio near that value

* G.E.C. Research Laboratories, Wembley.

Fig. 1.—Basic principle of operation of the instrument



would be suitable, the value of C being adjusted to give a convenient unit of time for unit resistance. This unit need not necessarily be one second, as any other value may be employed so long as the values of the other components are suitably selected. To check when the correct value of V has been reached, a suitable indicator device having no conductance or capacitance below this voltage, such as a small discharge tube, is connected across the capacitor as T in Fig. 1a.

The measurement of the time duration for the capacitor C to charge to the required voltage is achieved by means of an independent circuit, R1, C1 and a discharge tube T1 (see Fig. 1c) the values being chosen so that the time for the voltage across C1 to reach a value which operates T1 is equal to the time interval for the device T in the first circuit to become conductive when the resistance R is one unit (such as 1 MΩ). Thus, in the example given above, the time of each cycle of the circuit C1, R1, would be one second, and the number of these cycles which would occur before the device T discharged would be a measure of the resistance R. The curve of the charge-discharge cycles of the capacitor C is reproduced in Fig. 1d.

If a capacitor of C μF is charged through a resistance of R MΩ and capacitance C_r μF from a d.c. source E it can be shown that the voltage V across the capacitor after t_2 seconds is given by the expression:—

$$V = E\left[1 - \frac{C}{C+C_r}\, e^{-t_2/R(C+C_r)}\right] \quad \ldots\ldots\ldots (2)$$

Suppose a value of C be chosen such that the desired voltage ratio $\frac{V}{E}$ is reached in one second when R is a true resistance equal to one megohm. If this resistance is replaced by another component which has a resistance of 1 MΩ as before, but also having a capacitance C_r, then the time interval will be reduced from one second to, say, t_x seconds. Similarly another resistance having the same capacitance C_r will have a resistance whose value will be given by the ratio $\frac{t_2}{t_x}$.

If an additional capacitor of value C_x microfarads is now connected in parallel with the existing capacitative resistor the expression (2) becomes:—

$$V = E\left[1 - \frac{C}{C+C_r+C_x}\, e^{-t_2/R(C+C_r+C_x)}\right] \quad \ldots\ldots\ldots (3)$$

Considering equations (2) and (3), for a given set of values C, C_r and C_x it can be shown that the ratio $\frac{t_3}{t_2}$ is a constant.

A series of straight line graphs can be plotted between t_3 and t_2 for different values of C_r. By joining equi-resistance points on each capacitance line a further graph will result. The value of t_2 when $C_r = 0$ is a function of the true value of resistance.

To find the true resistance of a capacitative resistor, the apparent resistances are measured with and without capacitor C_x;

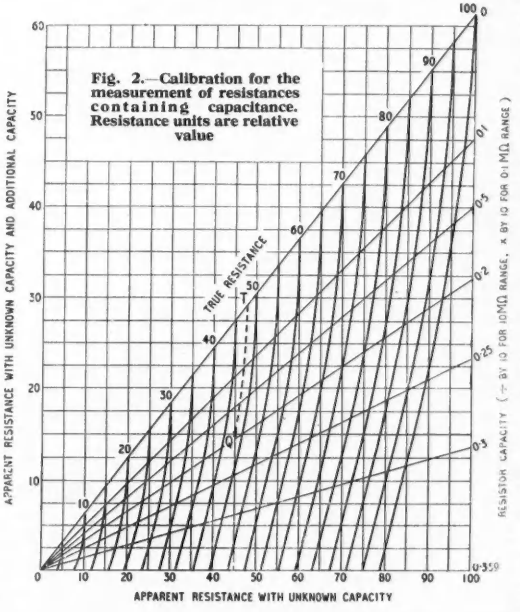

APPARENT RESISTANCE WITH UNKNOWN CAPACITY AND ADDITIONAL CAPACITY
APPARENT RESISTANCE WITH UNKNOWN CAPACITY
TRUE RESISTANCE
RESISTOR CAPACITY (÷ BY 10 FOR 10MΩ RANGE, × BY 10 FOR 0·1 MΩ RANGE)
0 10 20 30 40 50 60 70 80 90 100
0·1 0·2 0·25 0·3 0·5 1 2 5 10 20 50 100

Fig. 2.—Calibration for the measurement of resistances containing capacitance. Resistance units are relative value

these two readings will fix a point on the graph Fig. 2 which can be projected on to the $C_r = 0$ line. For example, readings taken in test positions 1 and 2 give a point Q on the chart. Point T will give the true resistance.

A general view of the instrument in one form is shown in Fig. 3. The resistance to be measured is connected to the "unknown resistance" terminals A. The electromagnetic counter B records units of resistance according to the position selected on the range-change switch C. The counter may be reset to zero by means of the knurled disc projecting through the front panel.

Operation of the push-button D energizes the starter relay which connects the supply to a circuit selected by the position of the five-way switch, E. The switch positions are indicated as follows:—(a) "Calibrate," (b) "Check voltage," (c) "Off," (d) "Test 1," and (e) "Test 2." In the "Calibrate" position a 5 MΩ high-stability resistor is introduced into the circuit and adjustment is made by means of the variable resistor F marked "Calibrate."

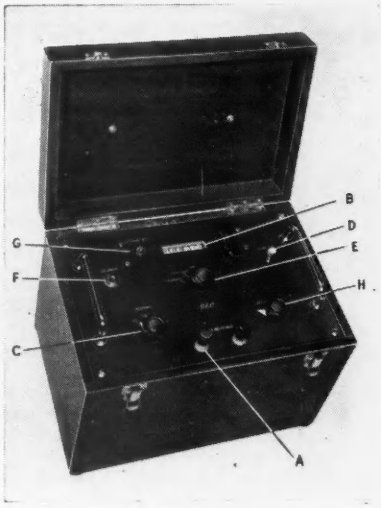
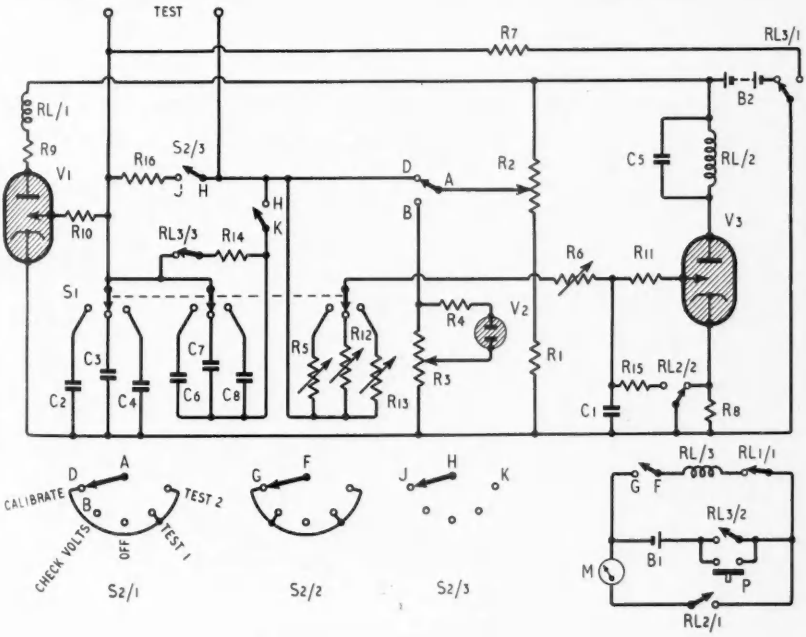


Fig. 3.—General view of the complete test set

Fig. 4.—Complete circuit diagram of the instrument



It is necessary to maintain a sensibly constant voltage to the charging circuits during operation of the instrument. In the " check voltage " position, adjustment of the voltage is facilitated by a neon indicator G which will strike at the correct voltage; control is by a variable resistor H which may be adjusted until the neon just strikes.

For pure resistance measurements " Test 1 " position only is used. For resistances containing capacitance, measurements are made with the selector E first in position " Test 1 " and then in position " Test 2," the true resistance being obtained from the calibration chart Fig. 2. At the end of each test the instrument automatically switches itself off.

The complete circuit diagram (Fig. 4) can be conveniently considered under four headings: timing circuit, measuring circuit, range changing, and power supply.

In the timing circuit a capacitor C1 is charged through a resistor R5, R12 or R13 in series with resistor R6 to a predetermined voltage from a d.c. source. Across the capacitor are connected the cathode and trigger electrodes of a cold cathode gas-filled valve, the anode being connected to a higher potential through the operating winding of a relay. When the capacitor attains the striking voltage of the valve, the latter becomes conductive and a current will flow in the operating winding of the relay RL/2 causing it to be actuated.

Change-over contacts are arranged on the relay so that, in their normal position, the valve will conduct when the capacitor has attained the striking voltage. When the relay has been actuated the energy stored in the capacitor will be discharged by the change-over contacts and the valve will cease to conduct. At this stage a further charge-discharge cycle will be started, the time period being adjusted by the preset variable resistances through which the capacitors are being charged. The variable resistor R6 is provided for subsequent calibration. The operation of the relay will connect a supply with an electromagnetic counter, each charge-discharge cycle being recorded.

In the measuring circuit a capacitor C2, C3 or C4 is charged through the unknown resistor to a predetermined voltage from a d.c. source. Across the capacitor are connected the cathode and trigger electrodes of a cold cathode gas-filled valve; the anode is connected to a higher potential through the operating winding of a relay RL/1.

When the capacitor attains the striking voltage of the valve the latter will become conductive and a current will flow in the operating winding of the relay the action of which interrupts the supply to the relay RL/3 in the starting circuit. This in turn will disconnect the supply to both timing and measuring circuits.

For the measurement of resistances having capacity, an additional capacitor is provided which can be connected in parallel with the resistor by means of the selector which is in " Test 2 " position.

The time taken for a capacitor to attain a predetermined voltage when charged through a resistor is inversely proportional to the value of capacitance. By means of a selector switch, capacitors which are in the ratio of 1, 10 and 100 are connected into the measuring circuit for recording 10, 1·0 and 0·1 MΩ units. To compensate for variations in capacity permissible under manufacturing tolerances, a preset variable resistor is connected into the timing circuit for each range.

The power supply to the instrument may be obtained from three miniature dry batteries or from a mains unit. In the case of a battery supply, two are connected in series and provide a nominal e.m.f. of 135 V for the charging circuits; the third battery supplies energy at 67·5 V to the counter and starting relay.

A variable potential divider is connected across the supply to the charging circuits so that a constant operating voltage may be obtained. In order that the voltage may be checked, a neon indicator lamp is provided which can be introduced into the circuit by means of the selector switch in the position " check voltage."

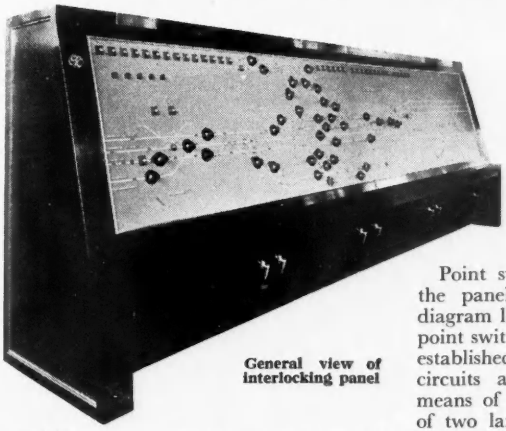
The voltage between the trigger and cathode electrodes of the cold cathode gas-filled valves is about 70 V; therefore the supply voltage to the capacitors being charged must be equal to $\frac{70}{0 \cdot 632} = 110$ V.

Power Station Grit Emission

Modifications are being made at the Buccleuch Street generating station in Barrow-in-Furness in the hope of abating the emission of grit, and the Town Council has deferred consideration of complaints until the alterations have been completed.

Railway Signalling

British System in United States



General view of interlocking panel

THE sequence switch interlock signal system originally supplied by Standard Telephones and Cables, Ltd., for the Eastern Region of British Railways at Doncaster has now been successfully put into operation at Gresham, Chicago, U.S.A., for the Chicago, Rock Island and Pacific Railroad. As at Doncaster, the signalling is controlled from a panel operated on the route-setting principle. This simplifies the signalman's job and eliminates the physical effort normally entailed in setting up the routes.

At Gresham two routes cross and some 50 passenger trains are operated on the north/south routes via Washington Heights and about 80 on the Beverley Hills line. In all, the system accommodates more than 190 moves through Gresham daily, and these occur in two peaks, in the morning and evening.

The interlocking panel carries a mimic diagram of the Gresham track layout with route selection keys mounted in positions corresponding to the relevant signals. Associated with each route selection key is a pair of indicating lamps representing the "On" or "Off" aspects of the signal concerned. The direction of travel associated with each route selection key is denoted by the pointed end of the escutcheon plate, the various routes available from that key being engraved around the knob of the key.

Point switches and slips are shown on the panel by lamp displays, the track diagram lines being continued through the point switch indication to show the routing established. In the same manner, track circuits are repeated on the panel by means of track indicators, each consisting of two lamps in parallel. The extent of each track circuit is indicated on the diagram by coloured track lines so arranged that no two adjacent tracks are the same colour.

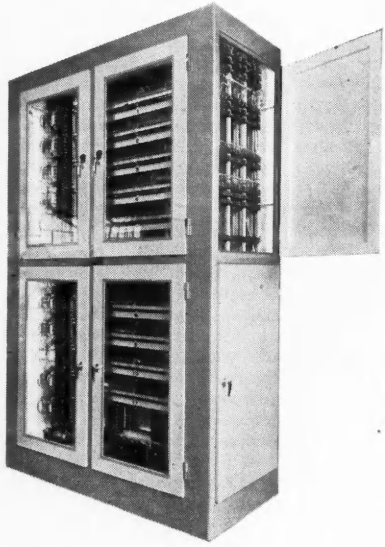
Along the top of the panel is a row of three-position keys associated with the various switch point controls for setting point switches independently of the route selection keys. In addition, there are a number of reverse route keys, etc., which are associated with special movements within the Gresham area.

The right-hand section of the control panel has been provisionally lined to represent the Beverley Junction, Beverley Hills and Washington Heights areas, and if at a later date this area is to be brought into the scheme it will be a simple matter for this section of the panel to be replaced by a new one showing the track arrangement in detail and complete with the necessary route selection keys, switch point indications and track indications.

The signalman selects a route by rotating a particular key. This prepares the route-setting equipment and when the knob of the key is depressed the sequential control of the point switches to line up the route is selected, and finally the signal to clear the route is indicated on the mimic diagram by lamp signals. The lamp indicators represent the position of each point switch so that the overall route selected is clearly shown.

A green lamp adjacent to the escutcheon of the route selection key lights when the signal is cleared. When the train accepts and passes the signal the aspect changes, this change being repeated on the panel alongside the escutcheon by the illumination of a red lamp. The signalman can then pull the knob of the route selection key to restore it to its normal position, but while the train is in the section no further selections will be effected until the route is clear. Progress of the train through the section is shown by track occupancy indicator lamps on the diagram.

The electrical interlock is obtained by sequence switches mounted in a steel cubicle equipped with access doors at the front and back, the front ones being equipped with glass panels. Each cubicle can accommodate eleven interlocking sequence switches, together with the associated auxiliary relay units. The sequence switches are driven by motors mounted in duplicate at the base of the framework by a vertical shaft connected through suitable gearing. One end of the cubicle accommodates the terminals required for connection to the control panel, other cubicles and outside equipment.



Each of these cubicles accommodates 11 interlocking sequence switches

One sequence switch can control up to eleven conflicting routes and since a sequence switch can be in one position only at a time the interlocking between routes is obtained mechanically. Non-conflicting routes which are to be selected simultaneously must be controlled by different sequence switches. Sequence switches return automatically to normal after clearance of the route. As they cannot be selected except in the normal position there is no possibility of wrong routings being made. The Gresham plant is equipped with a total of 25 sequence switches.

The design and manufacture of the equipment was undertaken at the New Southgate factories and installed in Chicago under the instructions of the company's British engineers.

American Research Fellowships

IN response to a request from the Organization for European Economic Co-operation, the United States Government has provided funds of over a million dollars to enable 150 outstanding young scientists from Europe to travel to and live in the United States for up to two years in order to study and gain experience in American research institutions. The funds are available in the first instance until the end of 1955. The National Academy of Sciences, Washington, is administering the scheme and the Royal Society has accepted an invitation to advise on the selection of candidates from the United Kingdom.

Successful candidates will be placed in American universities to participate with American colleagues in current fundamental scientific research as closely as possible related to their own fields of interest. Opportunities may also be provided towards the end of the tenure of the fellowship for work on problems in industrial or other laboratories in applied research.

About twenty-five fellowships will be open for award to candidates from the United Kingdom. No age limits are specified but it is expected that most of the successful candidates will be between 26 and 32 years of age. Applications will be considered from candidates who propose to do research in the natural sciences and in the engineering, agricultural and medical sciences. They must be in possession of a recognized doctorate in science or have equivalent experience. For the first two sets of applications the closing dates are respectively 1st October and 30th November. Forms of application and further information are obtainable from the Assistant Secretary, The Royal Society, Burlington House, London, W.1.

COMMERCE and INDUSTRY

Belfast Boiler Contract

E.D.A. Public Speaking Competition

THE Belfast City Council last week rejected a recommendation of its Electricity Committee that the contract for boiler plant for the new Victoria power station, valued at nearly £3 million, should not be advertised. The Committee had tentatively awarded the contract to Babcock & Wilcox, Ltd., without public advertisement, and the matter became the subject of an application to the Northern Ireland High Court for a writ of mandamus. The judge held that a breach of statutory duty by the Corporation had been established and adjourned the matter to enable the Corporation to comply with its standing orders relating to the advertising of contracts.

At last week's meeting the Council decided, by 25 votes to 23, that the boiler plant contract should be publicly advertised; it overruled the Committee's contention that "special considerations" existed which justified departure from standing orders.

In the High Court on 17th September Mr. Justice Curran awarded his costs to Alderman C. McKee who was the principal plaintiff in the case against the Corporation. The judge was informed of the Corporation's decision to advertise for tenders. He said that the Corporation's officials were not to blame for the previous actions.

Australian Import Relaxations

Following upon the announcement of the further relaxation of import restrictions by the Australian Government, it is now stated that the licensing period will be six months, instead of three months. Thus at 1st October the quota available to an importer will amount to a half of his annual quota (provided he has not exceeded his previous quota).

Category "A" goods are to be licensed to the extent of 90 per cent (against 80 per cent) of the base year imports and Category "B" goods to the extent of 50 per cent (against 40 per cent). Items marked "Adm." in the Schedules are to be licensed on a 50 per cent (against 40 per cent) basis or 70 per cent (against 60 per cent).

Building Trades Exhibition

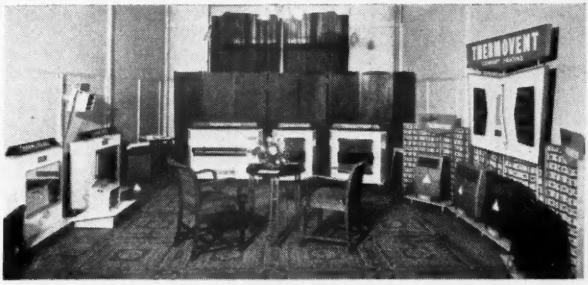
The Building Exhibition, one of the oldest of all British trade exhibitions, celebrates its silver jubilee at Olympia, London, from 18th November to 2nd December. About 500 exhibitors representing the fifty trades that comprise the building industry of this country will be found on the 600 stands.

German-Argentine Trade

Some details are given in the *Monthly Journal* of the British Chamber of Commerce in the Argentine Republic of the trade agreement between Germany and Argentina signed on 29th July. Under this Western Germany agrees to supply goods valued at $136·6 million annually. The list includes communications and special electronic apparatus ($2 million); materials for the manufacture of incandescent and fluorescent lamps ($550,000); materials for dry batteries ($600,000); "materials for electricity, wireless, telephony, excluding wires and cables" ($3,465,000); and electric wires and cables ($700,000).

"Thermovent" Exhibition

In our last issue we referred to the trade exhibition of "Ekco Thermovent" heating equipment which is now touring the Provinces.



The exhibition of "Thermovent" heating equipment which is now touring the Provinces

This includes the new " FR " and " SR " series of Thermovent convection heaters. The general layout of the display is shown in the accompanying picture.

Scottish Factory Opened

Mrs. D. Fraser, widow of the late Mr. J J. Fraser, managing director of Honeywell-Brown, Ltd., officially opened the company's Newhouse estate factory on 18th September. The opening followed a three-day conference at Gleneagles at which sterling area representatives of Honeywell-Brown from Sweden, Belgium, Holland and other countries attended to discuss requirements and sales plans for the expanded production. The new factory will make and market the latest electronic version of the company's " Modutrol " equipment, a new development in this country After 4½ years in Scotland the company now sells about 70 per cent of its production in overseas markets.

Public Schools and Industry

Masters from public schools in England recently toured factories in and around Leicester as part of a five-day convention planned to encourage public schoolboys to enter industry. The representatives at the convention, which was arranged by the Public Schools Appointments Bureau and the Brush Group, visited the British United Machinery Co., Ltd., Leicester, the Rootes Group, Coventry, and the Brush Electrical Engineering Co., Ltd., Loughborough.

Mr. Hugh Lyon, director of the Public Schools Appointments Bureau, in his speech of welcome to the delegates at the University College, Leicester, said that industry and commerce needed a much larger proportion of the abler type of public school-boy than they were getting at the present time. During their visit to the Brush Electrical Engineering Co., Ltd., the delegates watched the assembly of switchgear, transformers, diesel-electric locomotives and turbines. Winding, machine and fitting shops were also visited and the party was given a high-voltage demonstration in the laboratory.

Canadian Engineers in Britain

Thirty-six Canadian engineering graduates have just arrived in the United Kingdom to take up Athlone Fellowships, awarded by the British Government, and before dispersing to engineering concerns, universities and colleges in various parts of the country, the British Council arranged a short " introduction to Britain " programme in London, from 21st to 24th September. The visitors were welcomed by Sir Edward Hodgson, vice-chairman of the Athlone Fellowships Managing Committee, and talks were given on British social and economic structure, on aspects of British industry, including industrial relations, training schemes and trade unions. They also saw documentary films on England, Scotland and Wales.

Motor Control Gear Exhibition

At the Grand Hotel, Birmingham, last week, Arrow Electric Switches, Ltd., held an exhibition of its motor control gear. A comprehensive range of direct-on-line starters, magnetic contactors, relays, etc., was arranged on tables in a well-lighted room and in the centre there was a control panel on which control equipment was mounted The display was supervised by Mr. E. H. Foster, A.M.I.E.E., of the company's Motor Control Gear Division.

Penzance Trades Fair

At the invitation of the South Western Electricity Board the English Electric Co., Ltd., gave demonstrations at the Trades Fair held recently at Penzance, Cornwall. The accompanying picture shows the automatic washer with rotary ironer attached, the washer and wringer, the 2009D cooker, the 76A refrigerator and two more cookers. Miss June Oddy of English Electric is the demonstrator.

English Electric at the Penzance Trades Fair

" Sponsored " Television

One of the attractions at an exhibition held this week by the Nottingham Radio and Television Society has been a demonstration

of "sponsored" television arranged by the Nottingham Group of the Radio and Television Retailers' Association. A 15-minute demonstration of modern cookery has been given by Phyllis Craddock, a well-known writer and broadcaster. The programme, sponsored by the Simplex Electric Co., has been staged in a studio accommodating 300 people and reproduced by means of closed-circuit television in the hall capable of holding about 3,000.

B.T.H. Company Fined

At Rugby on 16th September the British Thomson-Houston Co., Ltd., was summoned for permitting acid effluent to be discharged into the Avon. A representative of the Severn River Board said that this had caused the death of fish for a stretch of thirteen miles and Coventry had had to stop taking water from the river for a day or two.

It was stated for the company that there had been no deliberate intention to pollute the river, or negligence. The contents of a plating vat had been flushed into the acid drains as had been done several times previously without complaint. Another method of dealing with the liquid was now being used.

A fine of 30 guineas, with 35 guineas costs, was imposed on the company.

Indian Dry Battery Industry

Because it considers that the native dry battery industry is not at present exposed to any threat of foreign competition, by reason of the Government's import policy, the Indian Tariff Commission considers that the measure of protection granted to the industry need not be continued beyond the end of this year. The Commission also recommends the industry to take steps to increase the use of home-produced materials and to make fresh efforts to form a trade association.

International Marine Radio Conference

The Thirteenth Conference of the Radio Marine Associated Companies (R.A.M.A.C.) has been held this week at the offices of one of the British member companies, the Marconi International Marine Communication Co., Ltd., Marconi House, Strand, W.C.2. The R.A.M.A.C. is an association of twenty-five marine radio operating companies representing nineteen different countries. Mr. H. C. Van de Velde, deputy to the managing director of the Marconi International Marine Communication Co., Ltd., is chairman, and Mr. E. Fost is secretary-general.

Domestic Appliance Display

The accompanying illustration shows a stand arranged by the Simplex Electric Co., Ltd., at an "At Home" Exhibition organized last week at Lewisham Town Hall by the Electrical Association for Women. The display included

Creda display at the Lewisham exhibition

the "Comet" horizontal type cooker, the EV13 cooker, a new "Redhead" immersion heater, 1½ gal and double-purpose water heaters, a "Halo" iron and two fires from the Creda range—the "Teal" reflector type and the "Marlow" coal-effect fire.

Public Speaking Competition

The final date for accepting entries for the 1954 E.D.A. Public Speaking Competition is 1st December. The subjects set for the competitors' choice are "The Housewife in the Reign of the Two Elizabeths," "Life Without Electricity," "Bringing Electricity to Rural Areas" and "The Place of Electricity in the National Economy." Entrants can speak on any one of these subjects for 15 minutes.

There are two sections, for men and women, respectively, employed in the electricity supply industry who have not attained their 35th birthday on 31st March, 1954. A 20-page booklet just published, "E.D.A. Public Speaking Competition, 1954," gives full details of the rules and of the subjects for the talks in next year's competition, as well as some useful hints to competitors. Copies of the booklet (E.D.A. 1644/G) are available free of charge from the Area Electricity Boards, or from E.D.A., at 2, Savoy Hill, London, W.C.2.

Contractors' Country Allowance

As from 14th September the country allowance for employees of members of the National Federated Electrical Association has been increased by 1s to 7s per night.

Industrial and Factory Law

A two-day tutorial course in industrial law for executives and managers of industrial and commercial firms will be held from 6th to 8th October at the Exchange Hotel, Liverpool. The lecturer is Mr. Harry Samuels, M.A., Barrister-at-Law (author of "Factory Law,"

"Industrial Law" and "Law of Trade Unions"). Applications may be made to the Secretary, Industrial Welfare Society, 48, Bryanston Square, London, W.1, from whom further information may be obtained. (Telephone: Ambassador 2401/6.)

Overseas Trade in August

Exports of electrical goods and apparatus from this country during August had a value of £7,279,585, as compared with £7,496,344 in August, 1952. Electrical machinery and heavy apparatus exports were valued at £5,129,093 against £4,597,230 in the corresponding month of last year. Details of the trade will appear in next week's issue.

Change of Name

The Vio-Ray Electric Co., Ltd., has changed its name to Myn Appliances, Ltd.

Tungsten Ore Prices

The Ministry of Materials announces that from 16th September, 1953, its selling price for tungsten ores of standard 65 per cent grade and ordinary quality have been reduced as follows:—Wolframite from 327s 6d to 310s, Scheelite from 312s 6d to 300s per long ton unit delivered consumers' works.

Molybdenum Restrictions Removed

The Minister of Supply has removed the restrictions on the use of molybdenum in alloy steel. Restrictions on the use of nickel and molybdenum in certain forms of alloy steel were imposed in June, 1952, owing to their scarcity. Improved supplies of molybdenum have enabled the restrictions on this material to be removed. The restrictions on the use of nickel in alloy steel will continue in force for the time being. This relaxation of control follows the recent announcement by the Council of O.E.E.C. of its decision to suspend molybdenum restrictions in member countries.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £150 0s 0d
COPPER, H.C. Electro	ton £232 10s 0d
Fire Refined 99·70 per cent ..	ton £231 0s 0d
Fire Refined 99·50 per cent ..	ton £230 0s 0d
COPPER Tubes	lb 2s 3¼d
Sheet	ton £291 10s 0d
H.C. wire and strip	ton £264 5s 0d
LEAD, English	ton £90 10s 0d
Foreign	ton £89 5s 0d
MERCURY	flask £64 15s 0d
TIN	ton £609 0s 0d
ZINC, G.O.B. Foreign	ton £67 0s 0d
Electrolytic	ton £68 5s 0d
BRASS Tubes	lb 1s 10d
Sheet	ton £233 10s 0d
Wire	lb 2s 5½d
PHOSPHOR BRONZE	
Wire	lb 3s 7¾d
RUBBER, No. 1 R.S.S. spot ..	lb 18⅜d-19·1

Trade Announcements

A new company, **National Plastics (Sales), Ltd.**, has been formed to handle the selling activities of **British Moulded Plastics, Ltd.**, London, and **Moulded Products, Ltd.**, Birmingham. This company, like the two manufacturing companies, is a wholly-owned subsidiary of National Plastics, Ltd. National Plastics (Sales), Ltd., will operate as from 27th September, and will be administered from Avenue Works, Walthamstow, but there will be offices in Birmingham at Moulded Products, Ltd., Chester Road, Tyburn, Birmingham, 24.

C. Ramon & Co., Ltd., 47, Great Russell Street, London, W.C.1, announce the opening of offices in East Africa. The address is C. Ramon & Co., P.O. Box 760, Mombasa, Kenya, East Africa. The branch is interested, *inter alia*, in electrical accessories and appliances, radio sets, refrigerators, fans, etc.

Catalogues and Lists

Record Electrical Co., Ltd., Broadheath, Altrincham, Cheshire.—Illustrated brochure dealing with the new "Record" graphic recording instruments.

Dennis Ferranti Co., Ltd., Royton, Lancs.—Illustrated catalogue dealing with distribution transformers which also includes an extract from the B.E.A. specification T.1 covering standard sizes of pole type and substation transformers up to 1,000 kVA.

Synthetic Carbon & Engineering Co., Ltd., Cumberland Road, Stanmore, Middx.—Two leaflets on a trailing tandem brush holder (3Y) and carbon contacts (Y4) together with a data sheet for contacts.

Micanite & Insulators Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, London, E.17.—Three technical publications entitled Electrical Insulation (G.1/53), Mica and Micanite (MT-3/53) and "Paxolin" synthetic-bonded boards (P.N.1/53).

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Marco" cable trunking.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Battery Torch

TO meet the demand for a high quality two-cell torch at a reasonable price the "Ray-o-Vac" flashlight is being put on the market by ALPHA ACCESSORIES, LTD., Treorchy, Glamorganshire. It is Empire made to an American

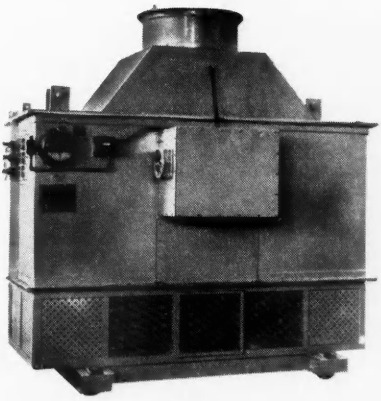
"Ray-o-Vac" flashlight

specification with a heavily plated brass body, three-position switch and signal button, parabolic reflector, polished ground glass lens and prefocused bulb. It is packed in an attractive carton and costs 9s 7d, including purchase tax in the United Kingdom.

Air Cooled Transformers

Air cooled transformers with ratings up to 5,000 kVA at 11 kV are now available from TRANSFORMERS (WATFORD), LTD., Sandown Road, Watford, Herts, and units rated at 750 kVA and 2,000 kVA at 6·6 kV have recently been installed in a large rubber producing plant overseas. The illustration shows a 2,000 kVA, 6·6/3·3 kV transformer with fire resistant windings which is believed to be the largest dry type unit produced in this country. It compares very favourably with developments in the United States where dry type units are used more extensively than here on account of the more stringent regulations on the use of oil immersed equipment in buildings. One of the main features of the company's air cooled unit is the wide and unrestricted axial vertical cooling ducts so arranged that, in operation, dust and other accumulations present no problem.

Transformers (Watford) 2,000 kVA dry type transformer

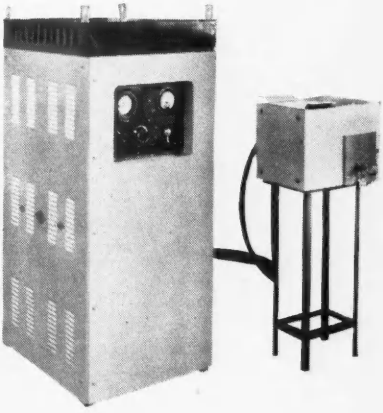


Induction Heater

Several of the disadvantages usually associated with h.f. induction heating equipment are overcome in the 5 kW unit made by AIRMEC LABORATORIES, LTD., High Wycombe, Bucks. Both manual and automatic power control facilities are incorporated, thus enabling a high standard of heating precision to be obtained, particularly in repetitive operations.

The problem of heating objects at a distance has been solved by providing a small remote work unit which enables articles to be heated up to 12ft away from the generator without any loss of power. The generator, continuously

Airmec 5 kW induction heater



operated, is rated to develop a maximum power of 5·5 kW in the work, and the difficulty of obtaining optimum power in widely differing conditions has been overcome by providing unusually versatile output matching facilities.

Insect Repelling Lamps

The new Crompton "Buzz-Away" lamps now available from CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2, have been developed to provide a light source that does not attract moths, flies, etc. The lamp emits a primrose yellow light, pleasant to the human eye but quite neutral where insect life is concerned, since colours attractive to insects are suppressed.

The makers claim that the lamps are ideal for outdoor illumination and also for certain classes of indoor lighting such as in food shops. The "Buzz-Away" lamp has a glass finish coating, highly resistant to the corrosive effects of the atmosphere, and provides adequate light for general purposes. It is available in 60 and 100 W sizes and is suitable for use on 200/240 V supplies. Prices are 1s 9d (60 W) and 2s 6d (100 W), plus purchase tax in the United Kingdom.

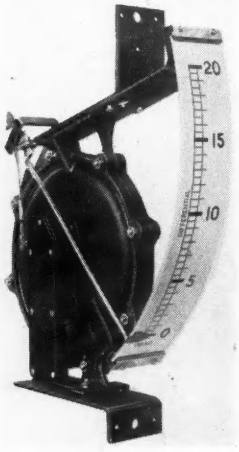
Differential Draught Gauge

One of the latest instruments made by GEORGE KENT, LTD., Luton, Beds, for assisting combustion control is a differential draught gauge. One of its many applications is on pulverized fuel fired boilers, the load on the mill being indicated by the differential pressure appearing across it.

The measuring element is a sturdy diaphragm-operated mechanism, movement of the diaphragm being transmitted to the light balanced pointer by a linkage system through a pressure-tight hat-leather gland. The pointer indicates on a bold vertical edgewise scale calibrated in differential pressure units. When internal illumination is required a translucent scale is used.

Consistent operation is ensured by the generous dimensions of the diaphragm and an accuracy of ± 2 per cent of maximum differential head is guaranteed. The ranges available are 0–2, 0–3, 0–4, 0–6, 0–9, 0–12, 0–16, 0–20, 0–25 and 0–30in differential pressure.

George Kent differential draught gauge



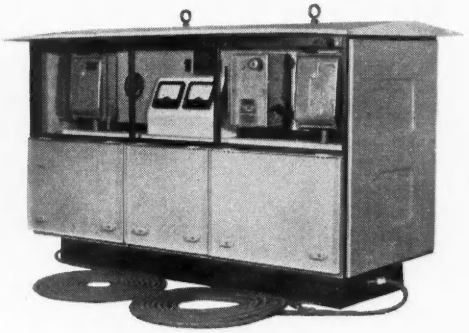
New Accessories

Several additions have been made to the range of 13 A switchsocket-outlets produced by M.K. ELECTRIC, LTD., Wakefield Street, London, N.18. These consist of designs with metal front plates for both surface and flush mounting but in horizontal boxes as opposed to the small square boxes at present in use. These items will incorporate single-pole or double-pole switches. The company has also introduced a comprehensive range of a.c. pilot lamp switch-socket-outlets for flush and surface mounting, fused spur boxes for flush and surface mounting, incorporating a single-pole isolating switch, and surface and semi-recessed a.c. slot switches on 2¼in bases. There is also a complete range of socket-outlets and switchsocket-outlets of all ratings of the surface metalclad type having solid brass front plates.

400 c/s Supplies

To meet an increasing demand by Government Departments and the aircraft industry the CITY ELECTRICAL CO., Emerald Street, London, W.C.1, has developed a range of frequency convertors. The standardized outputs at 400 c/s are 1½, 3, 5 and 10 kVA. Various arrangements are available for static installation or as mobile units. The illustration shows a weatherproof rig, with protecting upper panels removed.

City Electrical Co. 400 c/s supply unit



ELECTRICITY SUPPLY

Dunfermline Power Station

Melbourne Report

THE British Electricity Authority has received the consent of the Minister of Fuel and Power to the extension of the Dunfermline power station by one 12·5 MW turbo-generator set and two 80,000 lb/hr boilers. The present installed capacity of the station is 13 MW.

Power Station at Rogerstone

When it was announced early last year that the British Electricity Authority intended to build a generating station at Lower Machen, Monmouthshire the local councils and the National Farmers' Union made strong objection. A public inquiry was held and the scheme was not approved. The B.E.A. is now considering erecting the station at Rogerstone instead, but the local authorities and the National Farmers' Union again oppose the scheme. The B.E.A. has consulted the Usk River Board and various other interested parties, who all seemed in favour of the scheme, but a final decision depends upon the result of borehole tests which are now being made. The new station would entail the diversion of the River Ebbw and when completed would employ 150 men.

Pinkston Frequency Conversion

Glasgow Corporation Municipal Transport Committee has received the consent of the Secretary of State to the borrowing of £1,420,810 for frequency conversion at the Pinkston power station (to 50 c/s) and ancillary works connected with the scheme.

Handling Electricity Accounts

Mr. S. F. Steward, chairman of the South Western Electricity Board, recently visited the Central Billing Office of the Board at Plymouth, which is now handling the accounts for consumers throughout the whole South Western Area, from Bristol to Land's End. Mechanization, and the concentration of billing in Plymouth, have brought about considerable economies in the South West. Five years ago there were thirty-one different billing centres in the area. To-day 2¼ million bills a year, all of a standard type, are being handled at the Plymouth office, where one mechanical tabulator and its associated equipment will deal with 50,000 accounts each quarter compared with less than 2,000 accounts which could be handled by one clerk. By speeding up the preparation of bills and by promptly following up arrears, amounts owing by consumers have been halved in the past 15 months. This is saving over £20,000 a year in interest charges on the Board's working capital, to the benefit of all consumers.

More Farms Connected

Farms in the south west connected with electricity on 1st April, 1948, numbered 6,330 and on 1st April, 1953, the number was 11,711, representing an increase of 85 per cent as compared with about 55 per cent in other areas of the country. During the same period 44,428 other rural premises were connected. This information was given recently to the South West Board of Industry.

Cooker Maintenance

Because of heavy expenditure on the maintenance of electric cookers installed in Council houses, Lowestoft Corporation Housing Committee has accepted an offer from the Eastern Electricity Board to arrange demonstrations for tenants who may not be familiar with the manipulation of the cookers. It was stated that in the first six months of this year 277 repairs were carried out on electric cookers installed in 514 post-war houses.

Installation Costs

Having received notification from the Yorkshire Electricity Board that owing to rising costs it had been found necessary to increase charges for all installation and repair work, Dewsbury Housing Committee has decided to obtain prices from local electrical contractors for carrying out electrical installations and repairs in Council houses and a list of suitable contractors is being compiled.

Melbourne Engineer's Report

An increase of 2·3 per cent in sales of electricity is recorded in the report of Mr. B. Woodfull, city electrical engineer and manager, Melbourne Electric Supply Department, for the year ended 30th September, 1952. Restrictions on development were in force for most of the period but with a slackening of industrial and commercial activity towards the end these were mostly withdrawn. Of the 216·5 million kWh sold, commercial consumers took 105·4 million at 2·345d/kWh; industrial consumers 80·8 million

at 1·630d/kWh; domestic consumers 21·5 million at 2·278d/kWh; and traction supplies totalled 8·6 million kWh at 1·279d/kWh. There was a surplus on the year's trading of £55,998 (against £28,149); £45,000 of this was appropriated for the town fund. The State Electricity Commission's bulk supply tariff having been substantially increased, there were corresponding advances in the standard Metropolitan Detail tariff. The work of changing over from d.c. to a.c. was practically completed.

Turkish Hydro-Electric Project

Reports to hand from Turkey indicate that plans have been completed to build a new dam and hydro-electric power plant at Demirköprü on the Gediz River not far from Izmir. This project incorporates a 246ft dam with a reservoir capacity of 1·16 billion cu m to control periodic floods in the Gediz River Valley and (in conjunction with another reservoir on the Maramara Lake) to provide irrigation for 134,000 hectares of farming land. The power plant to be situated two miles from the dam will generate 152 million kWh per annum and this energy will be transmitted to users in the Gediz River basin by means of one 174-mile 154,000 V line and one 40-mile 33,000 V line. It is anticipated that the cost of this project will total about £8,000,000 of which some £3,500,000 will be needed in foreign exchange for the purchase of equipment abroad. The high-voltage transmission lines will cost an additional £9,000,000. The project is to be completed within three years, starting in the spring of next year.

Overhead Line Re-routed

The British Electricity Authority's proposed overhead line through parts of Redditch urban district has been re-routed so that it will not enter the area. Redditch councillors were almost unanimous in condemning the original proposal, which would have taken the line along the Hog's Back, one of the local beauty spots.

Glen Lussa Scheme

On Thursday last week the new generating station of the North of Scotland Hydro-Electric Board was opened. The new station houses two 1,200 kW turbo-alternators operating on a head of 380ft. The first set has been in operation since February, 1952.

Cookers in Council Houses

Stamford (Lincs.) Town Council has agreed that electric cookers may be installed in Council houses instead of gas cookers, where the tenants so desire. Each cooker will cost the Council £26 10s.

Quebec Farm Electrification

Premier Duplessis said on 1st August that the Quebec Government intended that electricity should be supplied to every farm home. In 1944 20 per cent of Quebec farms were electrified; to-day the proportion was 70 per cent. The electrification programme, started six years ago, put a brake on the exodus from the farms and made farming more attractive. Another result was that the value of farms automatically increased with the coming of electricity and production problems were eased at a time when manpower was a problem.

Street Lighting

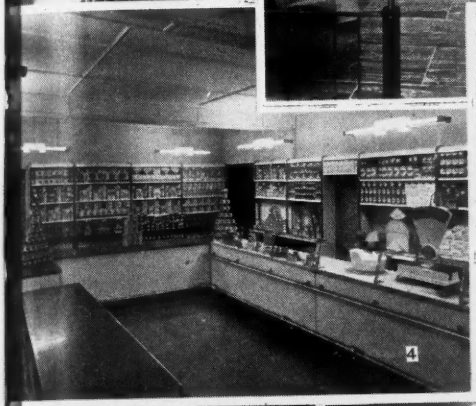
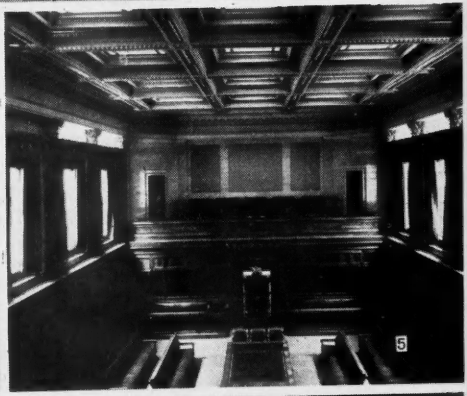
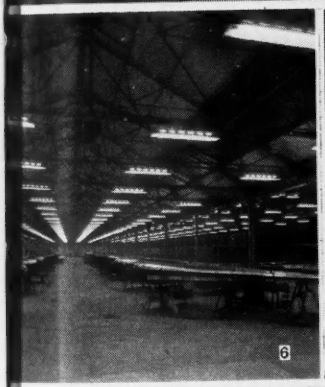
Work has begun on the scheme for improved street lighting in LONDONDERRY, and in the Rosemount area 15ft posts with mercury vapour lamps have been erected in place of the existing 9ft posts with gasfilled lamps. A new tower wagon is expected shortly when the conversion of 25ft posts to mercury vapour and the erection of additional posts will be proceeded with.

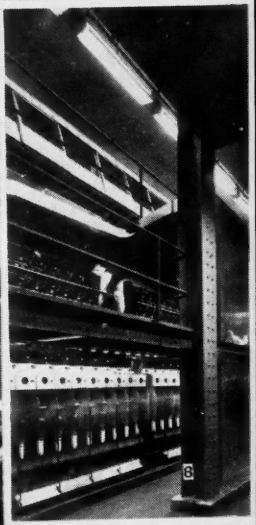
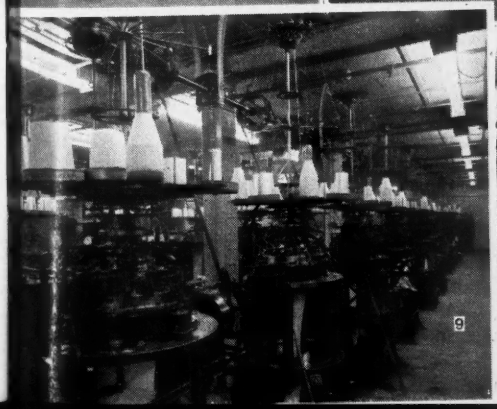
Seventy-two sodium vapour lamps along Crompton Way, BOLTON, have replaced 102 gas lamps. The switch-on by the Mayor of Bolton recently marks the completion of the illumination of the ring road by electricity. At Clarendon Street, Bolton, an experiment is being made of lighting a small stretch by bracket lamps fixed to the walls of property, instead of by standard lamps.

CLAYTON-LE-MOORS U.D.C. proposes to carry out a scheme for the re-lighting of Whalley Road and Church Lane with sodium lamps at an estimated cost of £4,400.

SOME RECENT LIGHTING INSTALLATIONS (*See opposite page*)

(1) Industrial reflector lighting fittings installed at the steel works of John Summers & Sons, Shotton (Wardle Engineering Co., Ltd.). (2) Tungsten (200 W) lamps recessed in the ceiling with a louvre suspended below the ceiling level at the National City Bank of New York, Waterloo Place, S.W.1. (Courtney, Pope (Electrical), Ltd.). (3) Laylight, 60ft by 30ft, at the M.C.C. Memorial Gallery (Crompton Parkinson, Ltd. Electrical contractors, Thorn & Hoddle, Ltd.). (4) Tungsten ballast lamp fittings in the grocery shop of Annfield Plain Co-operative Society (British Thomson-Houston Co., Ltd. Electrical contractors, Wire Electric Services, Ltd.). (5) Northern Ireland House of Commons fitted with fifteen laylights each with three Benjamin vitreous enamelled fittings, having Siemens daylight fluorescent tubes (Siemens Electric Lamps & Supplies, Ltd.). (6) "Atlas" white fluorescent tubes installed at an aircraft factory (Thorn Electrical Industries, Ltd. Electrical contractors, Alliance Electrical Co.). (7) Tungsten ceiling fittings at the British Railways Travel Centre, London (Falk, Stadelmann & Co., Ltd. Electrical contractors, N. G. Bailey & Co., Ltd.). (8) Spinning machines at the Carrickfergus rayon factory of Courtaulds, Ltd., lighting of which is by "Osram" fluorescent vapour-proof fittings (General Electric Co., Ltd. Electrical contractors, B. French, Ltd.). (9) Cold cathode lighting for circular and pearl knitters at the factory of Pool, Lorrimer & Tabberer, Ltd., Leicester (Metropolitan-Vickers Electrical Co., Ltd.). (10) Part of the cold cathode lighting installation in the new factory of Rolls-Royce, Ltd., East Kilbride (Edison Swan Electric Co., Ltd. Electrical contractors, James Kilpatrick & Sons, Ltd.)

South African Commission's Report

Power Station Construction Progress

EVERYTHING possible is being done to speed up the construction of new power stations and the extension of existing stations to meet the rising demand for electricity, states the South African Electricity Supply Commission in its annual report for the year ended 31st December, 1952. Although delay in deliveries of plant and equipment is by no means a thing of the past, it was less severe in 1952 than in the previous year, and the shortage of steel required for construction work was less acute. Consequently, it was possible to achieve during the year a better rate of progress with the erection of new power stations than at any time since the start of the Commission's programme of post-war expansion.

Construction Programme

The programme of new power station construction and extensions to existing stations involves capital expenditure now estimated at £91 million. This figure allows for the further extensions to Salt River No. 2, Taaibos and Vierfontein power stations, which were foreshadowed in the last report, and includes an increase of £13,215,000 on estimates of expenditure based on prices ruling at the time of placing the contracts. The aggregate installed capacity of the Commission's power stations at 31st December was 1,698 MW, an increase of 104 MW as compared with the previous year. The major items of plant commissioned during 1952 were two 190,000 lb/hr boilers and two 33 MW turbo-generators at the Vaal power station and two 200,000 lb/hr boilers and two 20 MW turbo-generators at the Hex River station. The report details the plant installed and the work proceeding on new power stations and on extensions to existing stations of the Commission.

In May, 1952, the chairman and general manager, the chief accountant, and the law adviser and secretary, visited the United States to raise money to finance the cost of providing power for the production of uranium, and they obtained a loan of $19·6 million from the Export-Import Bank of Washington. On their return they interviewed manufacturers of power station plant and equipment in Britain to expedite delivery.

Financing Rural Schemes

Because of shortage of money, the Commission has been able only on a limited scale to supply rural and other consumers who fall outside an established distribution system. In some areas groups of farmers financed the distribution equipment to obtain a supply of electricity. Where money is the obstacle to the furnishing of a supply, the Commission has established a scheme in terms of which the consumer pays for the distribution equipment and the Commission purchases the equipment from the consumer over a period of years.

The transmission system was extended from 7,413 route miles at the end of 1951 to 7,691 route miles at the end of 1952. The Commission's licensed area of supply is now 104,240 sq miles.

Electricity generated (8,778 million kWh) increased by 5·4 per cent, and sales (8,080 million kWh) by 8·4 per cent, mining consumption accounting for 4,585 million kWh. The average price per kWh sold was 0·3738d (against 0·3506d). The total revenue was £12,655,772, an increase of 15·5 per cent as compared with 1951, but costs (including interest, redemption and reserve fund charges) totalled £13,074,054, an increase of 17·7 per cent, and the deficit for 1952 was £418,282 (against a deficit of £146,929). Increases in tariffs were made in the Rand, Border and Cape Western undertakings.

Power Shortage in Spain

With water in the reservoirs well below the normal level, power cuts have been imposed in Spain, particularly in the south. In Madrid, except for industrial undertakings, consumers are without electricity on two days a week during daylight.

Engineering in Europe

Survey of Current Literature

THE "long-rod" insulator, being a late descendant of the well-known "Motor" insulator, is now widely used in Continental power systems. It has several advantages over its ancestor and also over a popular intermediate form known as the solid-core insulator, in particular the saving in weight and assembling labour achieved by the fact that the new type permits of using single elements where formerly multi-element strings were required. The number of sheds is considerably increased as against other types, but the shed diameters are much smaller. Cascading flashovers are prevented by the absence of intermediate electrodes on insulators up to 120 kV rating. Types for voltages up to 400 kV are fitted with arcing horns and grading shields and at these voltages even long-rod insulators (maximum length of element 1,400 mm) must be used in strings of up to three elements.

These insulators are puncture-proof and have very high values of dry and wet flashover strength in a.c. and impulse conditions. The mechanical strength and thermal resistivity, as established by all the up-to-date testing methods, are also very satisfactory. Among the latter methods, ultrasonic and temperature-cycle tests revealed a very low dispersion of the measured values which indicates the great homogeneity of the material of the insulators. About 110,000 such insulators have been in service in various European countries and also overseas, mostly for several years, and have answered very well.—"The 'Long-Rod' Insulator for High Operating Voltages," M. F. Dahl, *A.S.E. Bulletin*, Vol. 44, No. 13, pp. 557–559, 27th June, 1953, in German.

Cable Insulation

This author deals mainly with p.t. and p.v.c. insulation and how their basic electrical characteristics affect the design of cables, particularly of those for special purposes. The consideration is based on the well-known formulæ for the capacitance of cables with from one to four cores and explains the necessity and difficulties of controlling the field distribution inside the cables, and the problems arising from the use of different insulants, belting and armouring. The following section surveys the historic development of the new insulating materials and their partly different uses in various countries, considering artificial rubber products, and silicones and their advantages and disadvantages compared with p.v.c. and p.t. The particular merits of the latter are outlined in the last section of the article which is devoted to special cable constructions such as antenna cables, coaxial, telephone and l.v. distribution cables (p.v.c. and p.t.), h.v. d.c. transmission cables (p.t.) and cables for even more specialized purposes such as X-ray equipment, electro-precipitators, TV cameras and for lightning research.—"New Insulating Materials in Cable Engineering," R. Goldschmidt, *A.S.E. Bulletin*, Vol. 44, No. 12, pp. 543–551, 13th June, 1953, in French.

Negative Breakdown of Air

A simple formula has been derived for the negative breakdown voltage of air in the sphere-plate spark gap at atmospheric pressure which is suitable for overall calculations of the breakdown and critical corona voltage even for large sparking distances. The derivation is based on a concept successfully used in the theory of electric strength and of the corona discharge, viz., that the progress of the discharge from the cathode be considered as equivalent to the breakdown of a part of the discharge gap which has been bridged by the discharge. The latter makes the part so bridged ideally conducting, the resultant field being equal to that which would be produced by approaching the cathode to the anode by the same distance.

In the case of the sphere-plate combination this corresponds to an increase of the radius of the sphere by the length of the bridged section whilst the voltage remains

constant. The growth of the cathode sphere is accompanied by a modification of the field on the spherical surface, this field decreasing initially to a minimum and growing with further approach of the cathode to the anode beyond all limits. The postulate of a certain minimum value of the field strength at the point of the minimum enables a purely geometrical condition of the breakdown to be established. The determination of the minimum value of the field strength requires certain assumptions to be made about the mechanism of the discharge.—" Negative Breakdown of Air in a Sphere-Plate Spark Gap under Impulse Voltages," V. Pucher, *Ark. Fys.*, Vol. 6, No. 36, pp. 375–382, 1953, in German.

Tuning Petersen Coils

There are different schools of thought about the necessity or otherwise of tuning Petersen coils to resonance with the line capacitance. While previously the opinion predominated that ±20–40 per cent mistuning could not appreciably reduce the current-neutralizing action of the coil, a more cautious attitude now taken permits only ±10–15 per cent de-tuning.

A comprehensive theoretical analysis and striking high-speed photographs and oscillograms presented by the author prove both views to be erroneous, particularly since not only the fundamental of the residual capacitive fault current but also its harmonics are very appreciable. On the other hand, the dangers of surges after the clearance of single-phase earth faults without the intervention of Petersen coils must not be under-rated and are well illustrated by an oscillogram showing the almost vertical rise of the recovery voltage in such a case. Incorrectly designed Petersen coils with unsuitable tap-changing gear in themselves represent danger points (again illustrated by a picture showing a destroyed tap-changing switch).

The main stress must be laid on a coil design permitting smooth (not stepped) and rapid regulation to follow changes in the system capacitance. The authors' supervisory equipment developed for this purpose and described in full detail is an improvement on two previous equipments due to the A.E.G. and Brown-Boveri, respectively (and also described in the article). It permits of telemetering and supervisory control of the coil tuning.—" The Petersen Coil in H.V. Systems and a New Method of Determining its Tuning," J. Richtr and J. Heral, *Elektrotech. Obz.*, No. 2, pp. 76–92, February, 1953, in Czech.

Breaker and Divertor Design

This author considers new circuit breaker and surge divertor designs and the impact of the rapid development of moulded plastics on the design of surge divertors and instrument transformers. Since the survey deals only with products of the Oerlikon concern, whose principle is to build circuit breakers for more than 60 kV only as oil-poor breakers, but for lower voltages as tank-type, oil-poor and air-blast breakers, the large circuit breakers discussed represent only one line of development in this field. However, these breakers are produced for ratings up to 400 kV and are certainly of great interest. They are based on the counter-flow principle which answers well in rapid reclosing and for interconnector circuit breakers. Air-blast breakers of 1,000 MVA capacity (10 kV/4,000 A rating) are also described. The performance of the various breakers in resistance switching and in disconnecting idling lines and transformers is discussed.

The sections dealing with modern surge divertors and instrument transformers show the impressive reduction in size and improved mechanical strength of such apparatus owing to the use of moulded plastics as insulating and constructional materials. In the case of instrument transformers there is a practically unlimited variety of models obtainable to suit any special purpose and customers' requirements.—" New Developments in H.V. Engineering," A. Gantenbein, *E.u.M.*, Vol. 70, No. 11, pp. 237–247, 1st June, 1953, in German.

Proposed Santiago "Underground"

A recent decree authorizes the Chile Government to contract an internal or external loan up to 5,500 million pesos for the construction of an underground railway in Santiago. The loan would be repaid over a period of 20 years. Tenders are to be invited for the construction of the railway.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

A.C. Tripping Circuits

Two Possible Causes of Mal-operation

By R. W. BRIDGLAND, A.M.I.E.E.*

SIMPLE protection by time limit fuses is widely applied in the electricity supply industry due to its cheapness. It has, however, in the past been considered to have certain disadvantages. Where oil circuit breakers have been called upon to discriminate and open in a definite sequence when clearing a fault many have not done so correctly.

Tests have shown that under equal conditions modern time limit fuses of the non-rewirable type having characteristics similar to the curves (Fig. 1) are capable of reasonably consistent accuracy. They can in fact discriminate when the interval between two fuses is as little as 0·05 sec.

It is the purpose of this article to indicate two main causes of mal-operation and to suggest the way in which the practical design of a simple tripping circuit may be approached in order that its reliability under fault conditions may be improved.

In a typical system to be protected (Fig. 2) four substations A, B, C and D have incoming feeders through isolators on to the busbars and outgoing feeders protected by time limit fuses. The current transformers at each substation may be of different makes and types but are shown as having the same ratios for the sake of simplicity. Assuming that a fault current of 2,400 A flows to earth from the busbars at D, then 60 A would flow in each c.t. secondary. This current is shown (Fig. 1) as a vertical line and its intersection with the fuse curves gives the fusing time at each substation. It can be seen that the outgoing t.l. fuse from C would melt in 0·175 sec while B and A would tend to melt after further intervals of 0·1 sec and 0·125 sec respectively.

These times are adequate for discrimination and the intervals would be greater for smaller fault currents, giving better chances of correct operation. If all c.t.s in sequence through which the fault current passed had the same characteristics and if the fault current in each secondary could be limited to a value somewhere on the fuse curve, then very little trouble would be experienced with these simple circuits.

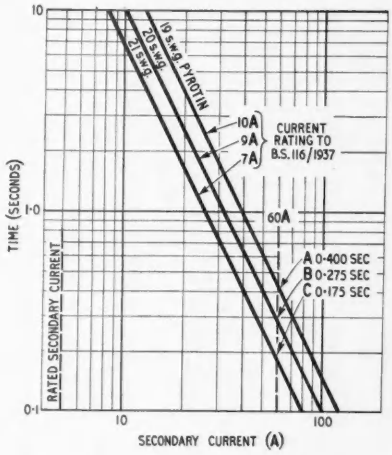


Fig. 1.—Characteristic curves of modern non-rewirable time limit fuses

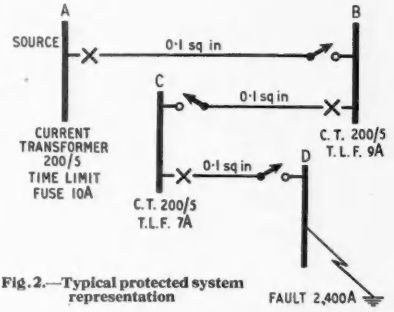


Fig. 2.—Typical protected system representation

* Assistant operation and maintenance engineer, East Sussex and South West Kent Sub-Area, South Eastern Electricity Board.

In practice, however, current transformers may be of the same ratio, but may vary considerably in the type and quantity of the iron used for the core. This variation affects the maximum saturated output voltage of the c.t. and in turn governs the maximum secondary current which can flow for a given burden. It is for this reason that mal-operations occur when the fault current is large enough to saturate one or all of the c.t.s.

Under these conditions the c.t. at C may be capable of supplying 25 V across a burden of 0·4 ohm, giving a current of 62·5 A in the secondary while the c.t. at B may saturate at 35 V, giving 87·5 A through the same value of burden. Reference back to Fig. 1 will show that although a larger fuse is fitted at B, it does not stand a chance of discriminating with C. The circuit breaker at C would tend to open in 0·16 sec with 62·5 A in the secondary, while B would actually clear the fault incorrectly in 0·13 sec with 87·5 A in the secondary.

The obvious remedy for this cause of mal-operation is to fit c.t.s which have the same characteristics. Where this is not practicable, a second method is to adjust the burden of each c.t. circuit so that the maximum saturated secondary current is the same in each case and is within the limits of the fuse curve.

This has the effect of allowing linear operation up to the point where the fuse becomes unreliable and providing a common current basis when the c.t.s saturate.

A second cause of mal-operation is often due to a d.c. component of the fault current, which can appear as a single energy current transient. Should the fault commence at some angle after the normal current zero, the displacement of the current vector from zero appears as a d.c. component. This gradually decreases to zero over a period depending upon the time constant of the system. A general figure given for this constant where the fault is close to source is in the region of 3 cycles. Not only can a d.c. component appear in the secondary of a c.t. circuit, but its effect may even be magnified by the magnetization curve of the c.t.

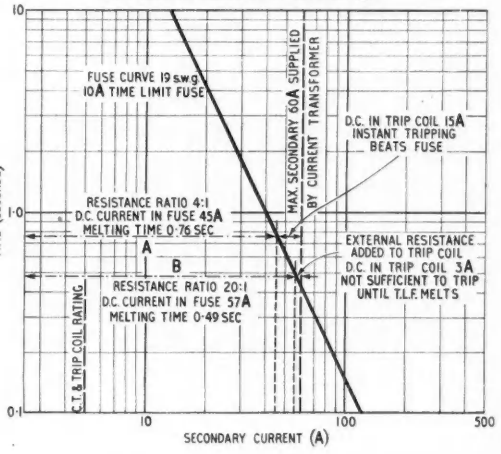
Under normal a.c. conditions, on the one hand, most of the secondary current flows through the time limit fuse, since the impedance of the tripping coil is high compared with the time limit fuse resistance. On the other hand, d.c. conditions set up a different state of affairs due to the fact that the reactance of the tripping coil has little or no effect. The spill current through the tripping coil in this case depends upon the ratio of the time limit fuse resistance to the resistance of the tripping coil. This ratio from tests carried out is in the region of 1 to 4.

Experience of many faults backed by practical tests has shown that a circuit breaker can trip and yet leave the time limit fuse intact when a d.c. of 25 A or more is present in the c.t. secondary circuit. When the d.c. spill current is large enough, the speed of tripping beats the melting time of the fuse as shown by "A" of Fig. 3.

When resistance is added to the trip coil, however, to increase its ratio to say 20 : 1, then the spill current can be limited to a value which will not trip the breaker until the time limit fuse melts as shown by "B" of Fig. 3.

The effect of adding resistance in the tripping circuit and its effect in limiting the current available for tripping, is not so

Fig. 3.—Effect of ratio of resistance between trip coil and time limit fuse (assuming 100 per cent d.c. component in fault current and current transformer saturating)



great as may at first be supposed, due to the reactive nature of the tripping circuit when the time limit fuse melts.

Although cases must be judged upon their individual characteristics and system requirements, the following approach may prove helpful when repeated cases of mal-operation are experienced.

Modification to design of existing a.c. tripping circuits will improve operation: (*a*) when one or more c.t. saturates before the others; (*b*) when the d.c. component of the fault current provides a large enough spill current through the tripping coil to open the breaker without the time limit fuse blowing.

In this connection it is reasonable to assume 100 per cent d.c. component for a short period, that is, when the fault occurs at 90 deg after current zero.

(1) Take a magnetization curve of the c.t. and find its saturated secondary voltage V_s (this should be done from a sinusoidal voltage source, such as a "Variac," by plotting the secondary voltage against secondary current, with the primary circuit open).

(2) Select a secondary current I_s near the upper current limit of the fuse curves. (The time interval between the curves for this current should be considered. The lowest interval should be greater than the breaker tripping time, particularly when breakers are of different types.)

(3) Find the value of the secondary burden to limit this current $R_s = \frac{V_s}{I_s}$

(4) Measure the actual burden of the ammeter leads and trip circuit, etc., with the time limit fuse in position = R (the burden with the fuse in is mainly resistive).

(5) The difference $R_s - R$ is the value of resistance required to be added to limit the maximum secondary current to the chosen base.

A.C. Conditions

(6) *Check*; assume the time limit fuse to have blown and check that the c.t. will provide adequate current to trip the breaker. (The circuit will now become largely reactive and the added resistive burden will have less effect.)

D.C. Conditions

(7) Determine a current that will not trip the breaker (say 4 A for a 5 A coil). The ratio of trip coil resistance to fuse resistance must then limit the d.c. spill current to this value. The required ratio = $I_s/4A$. When I_s is chosen as 60 A the ratio becomes 15 : 1. If the resistance of the fuse and clip, etc., is then 0·03 ohm the required resistance will be 0·03 × 15 ohms = 0·45 ohm.

(8) Additional resistance may have to be added in series with the trip coil to bring it up to the value calculated above.

(9) *Check*; assume the fuse to have blown and check that with the increased burden of the resistance added, the current is still large enough to trip the breaker.

The information contained in this article is based upon an investigation of an extensive 2·2 kV network having over 500 breakers protected by time limit fuses and fed from large capacity Scott-connected substations. Where faults have occurred in close proximity to these substations, as many as three breakers have opened when clearing the fault, without the time limit fuses blowing. All the breakers concerned had a reasonably high tripping speed, which is important for correct discrimination, and were of the same make. The ratio of trip coil impedance to fuse resistance was of the order of 12 or 15 to 1.

The addition of extra burden to circuits having a much higher ratio would possibly be impracticable due to limitation of the tripping current, but circuits of this type would tend to be more immune from mal-operation due to their self-limiting action.

Acknowledgment is made to the East Sussex and South West Kent Sub-Area manager, Mr. N. Boydell, M.I.E.E., A.M.I.Mech.E., for permission to publish this information, and to Mr. W. J. Phillips, A.M.I.E.E., operation and maintenance engineer.

Scottish Distribution Schemes

THE South West Scotland Electricity Board has authorized schemes for the reinforcement of supply in the eastern and southern parts of Rutherglen at an estimated cost of £13,676 and £17,800 respectively. The schemes provide for the establishment of new substations in Johnstone Drive, Bankhead Road and Cambuslang Road.

A scheme costing £14,254 has been approved for providing a supply of electricity to 251 new houses at East Kilbride.

A scheme to afford a supply of electricity to the National Coal Board at Bedlay Colliery, Lanarkshire, with a load that will ultimately reach 7,000 kVA, has been approved.

Financial Section

STOCKS and SHARES

THE past week in the Stock Exchange has been a period of adjustment to the Chancellor's surprise decision to lower the Bank Rate from 4 to 3½ per cent. Affecting as it does the whole range of interest rates on loans, the change produced an automatic marking-up of quotations for British Government stocks. At the same time, the operation was read as a signal of official confidence in the state of the nation's finances. The result was that the rise in prices subsequently gathered proportions ranking as spectacular by the relatively staid standards of the gilt-edged market. It also induced cheerful conditions over the industrial and other sections of the House. Chief reactions appeared in the " undated " Government stocks, War Loan rising from 83½ to 87 in the space of two days before going back to a little below that figure.

British Electricity Stocks

Although less volatile than such gilt-edged market favourites as War Loan and Consols, the medium- to long-dated Government issues have also scored satisfactory gains. Both the 3 per cent British Electricity stocks moved up by about a point and a half; the running yield in each case is now well under 3½ per cent, but the stock still pays more than 3¾ per cent, allowing for the capital profit on eventual repayment at 100. The 3½ and 4½ per cent British Electricity stocks advanced respectively by 1½ and ½ per cent.

Electrical Equipment Shares

Leading industrial shares responded without hesitation to the lead given by the gilt-edged market. Later, with other considerations being recalled to attention, some irregularity developed, but the more cheerful sentiment continued to predominate. Rises of 1s 3d in English Electric and 1s 6d in General Electrics were typical of the effect upon top-grade industrials. Improvements of a little more or less occurred fairly plentifully down the list of electrical shares. Brook Motors rose again, to 38s 9d, in anticipation of next month's bonus distribution. The rise in Southern Areas was carried further to 17s. H. J. Baldwin hardened to 4s 3d in advance of the coming new issues.

Decca Activity

High activity in the 5s ordinary shares of Decca Record calls persistently for comment in market reports. Recent dealings at around 31s 9d were a little under the top, but higher than any recorded for several years past. The quotation was no more than 17s 6d earlier this year, and failed to reach 20s in the previous twelvemonth. This year's events have included the 400 per cent share bonus (the effect of which was to write up the par value of the shares from 1s to 5s), the almost doubled trading profit reported for 1952–53, and the increase in the dividend from 112½ to a still well covered 150 per cent. Interim dividends for the year ending next March have been maintained at the equivalent of last year's, allowing for the increase in capital.

Aberdare Cables Shares

Aberdare Cables (Holdings) new 5s ordinary shares (the result of the share-for-share bonus) are being dealt in at about 8s 6d and will be transferable free of the 2 per cent stamp duty until the first week of October. They rank for the 5 per cent interim dividend recently declared on account of the financial year ending with next month. In correspondence with the doubling of the capital, this payment was half the interim dividend rate for 1952–53. On the basis of half the last total of 25 per cent, the yield on the shares is 7 guineas per cent. The final dividend was declared last time in January.

Palestine Electric

Palestine Electric £1 " A " shares were run up lately from 11s to over 17s on the strength of reports suggesting that the Israeli Government was to take a half interest in the undertaking, on terms which would assure the resumption of dividends at the rate of 6 per cent, tax free. The price went back to 16s on the absence of any reference to this proposition in the annual report issued a week ago. An early statement from the chairman was, however, expected.

Debenture Stock

Demands for industrial debenture stocks which give the investor a return slightly above the gilt-edged level, with first grade security, were increased by last week's events. Stock is very scarce, but it has been possible lately to buy moderate amounts of English Electric 4½ per cent debenture stock 1972–77 at around 104. (It was issued in July at 97½.) The yield is £4 6s 6d per cent, without allowing for the loss of the premium upon repayment at the due dates, or earlier, under the operation of the sinking fund. Cable & Wireless 5 per cent debenture stock, 1972–77, is occasionally on offer at about 104½, giving a running yield of a little over 4¾ per cent.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 21st Sept. 1953	Week's Rise or Fall	Est. Yield p.c. £	s	d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	89	+1½	3	7	6
Brit. Elec. 1974/77	3	3	87½	+1½	3	8	6
Brit. Elec. 1976/79	3½	3½	94½	+1½	3	14	0
Brit. Elec. 1974/79	4½	4½	101½	+½	4	3	9
Calcutta Elec. ..	6†	6†	20/-	—	6	0	0†
East African Power	7	7	24/6	—	5	14	3
Nigerian Elec. ..	10	10	24/-	—	8	6	8
Palestine Elec. "A"	5†	Nil	16/-	−1/-		Nil	
Perak Hydro-Elec.	Nil	Nil	16/6	—		Nil	
Equipment and Manufacturing							
AberdareCables(5/-)	20	25	8/6	+6d	7	7	0*
Aerialite (1/-) ..	83½	88½	8/9	—	10	1	10
Allen, W. H. ..	15	15	46/-	—	6	10	5
Aron Elec. Ord. ..	15	20	42/6	—	9	8	2
Assoc. Elec. Ord.	20	20	78/9xd	—	5	1	6
Automatic Tel. & El.	15	15	60/-	+6d	5	0	0
Babcock & Wilcox	18	18	66/6	+6d	5	8	3
Baldwin, H. J. (2/-)	20	20	4/3	+3d	9	8	4
Bakelite (10/-) ..	—	12½	19/6	+6d	6	8	3
British Aluminium	12	12	38/-	−3/-	6	6	3
B.I. Callender's ..	9	10	37/6	+6d	5	6	8
British Thermostat (5/-)	30	35	17/6xd	—		—	
British Vac. Cleaner (5/-)	25	25	13/-	+9d	9	12	4
Brook Motors (10/-)	20	20	38/9	+1/16	5	3	3
Brush Ord. (5/-) ..	10	4	4/-	—		—	
A. F. Bulgin (1/-)	30	30	3/-	+1½d	10	0	0
Burco (5/-) ..	38¾	35	18/3	—	9	13	0
Chloride El. Storage	15	20	77/6xd	—	5	3	3
Cole, E. K. (5/-) ..	25	25*	19/-	—	6	11	7
Cossor, A. C. (5/-)	Nil	10	8/6	—	5	17	8
Crabtree (10/-) ..	17½	17½	29/-	—	6	0	8
Crompton Parkinson Ord. (5/-) ..	11½	11½	11/6	—	4	17	10
De La Rue (5/-) ..	35	Nil	8/9	—		—	
Decca (5/-) ..	112½	150	31/9	+9d	4	14	6*
Dewhurst (2/-) ..	22½	19*	5/6	—	6	18	3
Dictograph Tel.(2/-)	20	20	5/6	—		—	
E.M.I. (10/-) ..	12	12	14/6	−6d	8	5	6
Electrical Components (5/-) ..	20	20	10/-	—	10	0	0
Elec. Construction	15	15	52/6	—	5	14	3
Enfield Cable Ord.	7½	5	21/3	—	4	14	0
English Electric ..	15	15	53/9	+1/16	5	11	6
Ericsson Tel. (5/-)	22†	22*†	39/-	—	2	16	5†
Ever Ready (5/-) ..	35	35	27/-	—	6	9	8
Falk Stadelmann	15	15	43/-	+9d	6	19	6
G.E.C. Ord. ..	22½	11½*	39/-	+1/6	5	15	5
General Cables (5/-)	30	30	16/3	—	9	4	8
Greenwood & Batley	15	17½	40/-	—	8	15	0
Hackbridge Cable (5/-)	20	20	12/9	—	7	17	0
Hackbridge Hewittic (5/-)	20	20	17/6	—	5	14	2
Hall Tel. Acc.(10/-)	10	10	10/-	—	10	0	0
Heatrae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (10/-) ..	20	10½*	17/-	—	6	3	6
Holophane (5/-) ..	15	20*	12/6	—	8	0	0
Hoover (5/-) ..	35	25	26/3	—	4	15	3
Equipment and Manufacturing (continued)							
Intl. Combustion (5/-)	25	15*	14/3	+6d	5	5	3
Johnson & Phillips	15	15	52/6	−6d	5	14	3
Lancashire Dynamo	12½	12½	43/9	+1/16	5	14	3
Laurence, Scott (5/-)	15	15	12/9	—	5	17	8
London Elec. Wire	12½	15	60/9	—	4	18	8
J. Lucas	7½	9½	43/-	−9d	4	5	3
Marryat & S. (2/-)	22½	22½	5/9	—	7	16	6
Mather & Platt ..	12½	15	51/6	+1/-	5	16	6
Metal Industries ..	15	12*	40/3	+3d	5	19	3
Mid. Elec. Mfg. ..	15	15	60/-	+1/9	5	0	0
Murex	15	15	54/6	—	5	10	1
Newman Ind. (2/-)	10	10	2/3	—	8	17	9
Oldham & Son (1/-)	35	17½*	2/6	—	7	0	0
Parnall (Yate) (5/-)	6	6	3/6	−3d	8	11	6
Parsons, C. A. ..	10*	12½	72/6	—	3	9	0
Plessey (5/-) ..	22½	25	26/9	—	4	13	6
Pye Deferred (5/-)	18	20	19/-	—	5	5	5
Revo (10/-) ..	27½	27½	16/3	—		—	
Reyrolle	10*	12½	65/-xd	+9d	3	17	0
Scot. Cable (4/-) ..	32	20*	12/9	—	6	5	6
Siemens Ord. ..	10	10	37/-	+2/-	5	8	0
Southern Areas ..	5	6	17/-	+1/16	7	1	3
Strand Elec.(5/-) ..	17½	17½	8/3	—	10	12	2
Sturtevant (5/-) ..	17¼†	18·1*†	26/-	—	3	9	9†
Sun Elec.	15	15	25/-	—	12	0	0
Switchgear & Cowans (5/-)	22½	22½	14/-	—	8	0	9
Taylor, T. (5/-) ..	20	25	20/-	—	6	5	0
T.C.C. (10/-) ..	20	20*	40/-	—		—	
T.C. & M. ..	10	8½*	28/6	—	5	19	1
Telephone Mfg. (5/-)	10	10	7/6	—	6	13	4
Thorn. Elec. (5/-)	10	12½	11/-	—	5	13	8
Tube Investments	25	15*	61/-	—	4	18	4
Vactric (5/-) ..	Nil	Nil	6/3	−1/16		—	
Veritys (5/-) ..	7½	10	4/6	—	11	2	2
Walsall Conduits (4/-)	70	70*	44/6	—	6	5	10
Ward & Goldstone (5/-)	45	45*	39/-	—	5	15	9
Watford (2/-) ..	25	25	5/-xb	—		—	
Westinghouse Brake	14	15	57/6	—	5	4	2
West, Allen (5/-) ..	15	15	12/3	—	6	2	5
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord. ..	—	6	84½	—	7	2	0
Ord.	—	3¾	57½	—	6	10	5
Anglo-Portuguese	8	8	21/9	+6d	7	7	3
Brit. Elec. Traction: Def. Ord. (5/-) ..	25	35	29/9	+9d	5	17	9
Cable & Wireless: Ord.	8	8	134½xd	—	5	19	0
4% Loan ..	4	4	97	—	4	2	6
Calcutta Trams ..	6†	6†	19/6	−6d	6	3	0†
Cape Elec. Trams	5	5½	10/-	—	11	0	0
Marconi Marine ..	10	10	28/-	—	7	2	10
Oriental Tel. Ord.	16	16	70/-	—		—	
Telephone Props.	8	8	5½	+1/16		—	
Tele. Rentals (5/-)	10	10*	9/3	—	5	8	1

* After capital bonus. † Dividends are paid free of income tax.

The above quotations are based upon the middle prices given in the Stock Exchange Daily Official List.

REPORTS and DIVIDENDS

Vactric, Ltd., reports that all indebtedness to H.M. Treasury has now been discharged. This has been achieved by a substantial reduction in stocks, by the sale of the greater part of the redundant plant at Newhouse and other fixed assets, and without increasing the group's bank indebtedness over its level at 31st March, 1952. Audited results for the year ended 28th March last will be available in early October, and will, as forecast at the last meeting, show a substantial loss. The directors estimate that the group net loss, after all charges, including interest and depreciation, will amount to approximately £135,000. Each division of the company and its subsidiaries is maintaining steady sales both at home and abroad, with a useful dollar contribution. In recent months the group has traded at a profit.

James Howden & Co., Ltd., in their accounts for the year ended 30th April last, show a profit after all charges, but not including taxation, of £706,335, as compared with £1,109,502 for 1951-52. Taxation requires £451,155, and general reserve receives £160,000. It is proposed to pay a final ordinary dividend of 22½ per cent, maintaining the distribution for the year at 30 per cent. The balance carried forward is £61,801 (against £56,711 brought in).

The Palestine Electric Corporation, Ltd., shows an operating surplus of I.£451,579 for 1952, a decrease of I.£256,362 as compared with the previous year. After meeting all charges the net balance is I.£36,344 (against I.£221,809 after tax provision in 1951 of I.£100,000). A sum of I.£53,086 is appropriated for preference dividends, and I.£508,966 is carried forward (against I.£525,708 brought in). No ordinary dividend is recommended.

Bennis Combustion, Ltd., reports a group net profit for the year to 30th April last, after charging £53,650 for taxation, of £63,920, an increase of £34,084 as compared with the previous year. The final ordinary dividend is raised from 5 to 7½ per cent, making 12½ per cent for the year.

The East African Power & Lighting Co., Ltd., reports a group profit for 1952 of £301,983, as compared with £310,426 for 1951. This is struck after deducting depreciation, but before allowing £32,346 for taxation. It is proposed to pay a final dividend of 4 per cent, making 7 per cent for the year on £3,113,333 ordinary capital, and a dividend at the rate of 7 per cent on the £1,737,777 new ordinary stock allotted in July, 1952. The balance carried forward is £157,205 (against £143,727 brought in).

W. T. Henley's Telegraph Works Co., Ltd., has declared an interim dividend of 2½ per cent on the ordinary stock of £4,875,000. This is equivalent to the interim payment for 1952 of 5 per cent on the then ordinary stock of £2,437,500.

Eveready South Africa, Ltd., reports a net profit for the year ended 30th June last of £73,247, as compared with £75,238 for 1951-52. Taxation absorbed £32,220. The dividend for the year is unchanged at 1s 3d per 5s share.

Thomas Bolton & Sons, Ltd., have declared an interim dividend of 2½ per cent (unchanged).

The British Aluminium Co., Ltd., is paying an unchanged interim dividend of 4 per cent.

New Companies

Prescott Engineers, Ltd.—Registered 4th September. Capital £100. Repairers and manufacturers of and dealers in general light engineering and electronic control gear, electrical machinery and goods, etc. Directors: W. O. Prescott (permanent) and W. J. Prescott. Secretary: Doris E. West. Regd. office: 29-31, Cowcross Street, E.C.1.

Carlin Feig Electric Motor Rewinding Co., Ltd.—Registered 14th September. Capital £500. Directors: I. Feig, Mrs. Jochabed Feig and T. Evans. Solicitors: Wilkins Rohan and Newman, 138a, King's Road, Chelsea, S.W.3.

Morris & Smiles, Ltd.—Registered 14th September. Capital £150. Electrical engineers and general electrical installation contractors, etc. Directors: D. J. Morris and S. M. Smiles. Regd. office: 148, High Street West, Wallsend on Tyne.

Dale Electric Contractors (Birmingham), Ltd.—Registered 14th September. Capital £3,000. Engineers, iron and steel founders, brassfounders, electrical engineers, etc. Directors: L. S. Webb and H. Webb. Regd. office: 12, Coleshill Street, Birmingham. 4.

Walkinstown Electrical & Radio Engineering Co., Ltd.—Registered in Dublin 28th July. Capital £3,000. Directors: Siegfried Dobrowitsch and Mrs. Margot Dobrowitsch, both of 2, Cromwellsfort Avenue, Crumlin, Co. Dublin.

Clipper Power, Ltd.—Registered 11th September. Capital £100. Designers, sellers

and manufacturers, importers and exporters of and dealers in transport, engineering, mechanical, electrical, electronic, marine, scientific, commercial or industrial machinery and equipment, etc. H. Propp is director and chairman. Regd. office: 3, Broad Street Buildings, Liverpool Street, E.C.2.

Associated Engineering Group, Ltd.—Registered in Dublin 23rd July. Capital £10,000. Electrical and mechanical engineers, etc. Subscribers: J. Maybury, 19, Botanic Avenue, Glasnevin, Dublin, and Mary Sheehy.

Harold Wells (Electrical), Ltd.—Registered 10th September. Capital £2,000. Manufacturers, wholesalers and retailers, importers and exporters of electrical and mechanical equipment, consultants and advisers on electrical and radio equipment, etc. The first directors are to be appointed by the subscribers. Secretary: N. L. West, 101, Leadenhall Street, E.C.3.

Increases of Capital

Reliance Electrical Wire Co., Ltd.—Increased by £75,000, in £1 ordinary shares, beyond the registered capital of £25,000. At 6th July, 1953, Reliance-Clifton Cables & Electrical Products, Ltd., held 98 ordinary shares out of 100 issued.

G. B. Carnegie & Co., Ltd.—Increased by £7,000, in £1 ordinary shares, beyond the registered capital of £500.

Designs & Installations, Ltd.—Increased by £5,000, in 4,000 ordinary and 1,000 preference shares of £1, beyond the registered capital of £5,000.

Electric Furnace Co., Ltd.—Increased by £100,000, in 22,143 7 per cent cumulative preference, 56,500 ordinary and 21,357 unclassified shares of £1, beyond the registered capital of £200,000.

Liquidation

Gordon Hughes Electrical Co., Ltd.—Members' voluntary winding-up. Meeting of members 19th October at 43, Silhill Hall Road, Solihull, to receive an account of the winding-up by the liquidator, Mr. D. A. Owen.

Bankruptcies

W. H. Collis, 59, King Street, Fenton, Stoke-on-Trent, electrical engineer.—Application for discharge to be heard on 22nd October at the Town Hall, Hanley, Stoke-on-Trent.

S. F. Bent, 16, Chatsworth Road, Droylsden, Lancs, electrician, formerly carrying on business as S. F. Bent & Sons, electrical contractors, at 362, Ashton New Road, Bradford, Manchester.—Trustee, Mr. F. C. Ormrod, 20, Byrom Street, Manchester, Official Receiver, released 10th September, 1953.

R. E. Browne, electrical contractor, carrying on business under the style of Browne Brothers at 121, Market Street, Dalton-in-Furness.—Last day for receiving proofs for dividend 3rd October. Trustee, Mr. D. Atkinson, 14, Lowther Street, Carlisle, Official Receiver.

W. P. Wann, carrying on business at Grape Lane, York, as "Electrical Service," formerly carrying on business at 41a, Petergate, and Grape Lane, York, electrical engineer.—Last day for receiving proofs for dividend 5th October. Trustee, Mr. W. H. Meredith, 29, East Parade, Leeds, 1, Official Receiver.

G. L. Milton and **A. Coates,** formerly carrying on business in partnership under the style of "Electro Radio," at 44, High Street, Buxton, radio and electrical contractors.—Trustee, Mr. F. C. Ormrod, 20, Byrom Street, Manchester, Official Receiver, released 11th September, 1953.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 9th October:—

MONITOR. No. 716,291, Class 9. Instruments for detecting and indicating fires, pressure gauges, pressure indicators, measuring instruments, revolution counters, speed-governors for gramophones, burglar alarm systems, transformers, batteries, accumulators, condensers, switches, switchboards and distribution boards.—"Monitor" Patent Safety Devices, Ltd., "Monitor" Works, Kings Road, Wallsend-on-Tyne.

HALOLIGHT. No. 717,280, Class 9. Radio and television apparatus and parts thereof included in Class 9.—Thorn Electrical Industries, Ltd., 105–109, Judd Street, London, W.C.1.

MIMCO. No. 718,063, Class 9. Scientific, nautical, surveying and electrical apparatus and instruments included in Class 9; radio sets (sold complete); photographic, cinematographic, optical, weighing, measuring, signalling and checking (supervision) apparatus and instruments; and parts included in Class 9.—Marconi International Marine Communication Co., Ltd., Marconi House, 336, Strand, London, W.C.2.

MULTICON. No. 718,932, Class 9. Electric plugs and electric sockets and parts included in Class 9.—Painton & Co., Ltd., Kingsthorpe, Northampton.

SUBSIG. No. 719,832, Class 9. Scientific, nautical and electrical apparatus and instruments, all included in Class 9; and measuring apparatus and instruments.—Submarine Signal Co. (London), Ltd., Shakespeare Street, Watford, Herts.

BOWSTRING. No. 719,837, Class 9.—Aerials and parts and fittings included in Class 9.—Belcher (Radio Services), Ltd., 57, Windsor Road, Slough, Bucks.

BUZZAWAY. No. 720,098, Class 11. Electric lamps.—Crompton Parkinson, Ltd., Netherfield Road, Guiseley, near Leeds.

CONGLASS. No. 717,884, Class 17. Electric insulators and parts thereof included in Class 17, and electric insulation materials, all being goods made wholly or mainly of glass.—Connollys (Blackley), Ltd., Blackley Vale Works, Blackley, Manchester, 9.

No. 720,219 (design), Class 17. Electrical insulating materials.—Langley, London, Ltd., 72, Borough High Street, London, S.E.1.

New York Power Station

Cross-Compound 160 *MW Sets*

A NEW power station to be built at Astoria in New York City by the Consolidated Edison Co. is to contain initially two 180 MW (160 MW nominal) cross-compound turbo-alternators with provision for four more units. According to the *Electrical World* the steam conditions will be 1,800 lb/sq in and 1,000 deg F, with reheating to the same temperature. Each set consists of a 3,600 r.p.m. high and intermediate pressure turbine and a 3,600 r.p.m. low-pressure quadruple exhaust turbine. There are seven stages of feedwater heating. Cross-compounding was adopted as providing higher overload capacity and because tandem compound machines for 3,600 r.p.m. and quadruple exhaust were not available when specifications were in preparation; capital expenditure was about 2½ per cent less. Previous experience with cross-compound 160 MW sets at 1,500 and 1,800 r.p.m. had indicated greater reliability and lower maintenance costs.

The alternators on each shaft are rated at 100 MVA (0·8 power factor) with hydrogen cooling at 0·5 lb/sq in, increased to 115 MVA at 15 lb/sq in and 125 MVA at 30 lb/sq in and have their 13·8 kV terminals interconnected. The neutral of the one driven by the high-pressure turbine will alone be earthed through a low reactance and circuit breaker. Main and pilot exciters will be used with a motor-generator for starting. There is to be a central control room for each pair of turbo-alternators.

Boiler Plant

The boilers (one for each set) are rated at 1,200 k lb/hr, but milling capacity (five pulverizers per boiler) allows for loading to 1,340 k lb/hr. They are to have "pressurized" furnaces to secure freedom from excess air infiltration; the higher cost of gastight casings is offset by the elimination of induced draught fans, forced draught being provided by two fans with a duty of 300,000 cu ft of air per minute. Variable speed drives were not found to be justified for this purpose or for the feed pumps. The twin furnaces will be of the dry bottom radiant type operating at a positive pressure of 22in of water and will be equipped with 22 circular burners designed for use with coal, natural gas or oil.

Ash Precipitation

The station site is within two miles of La Guardia airport where 125ft is a structure height limit, but permission was obtained to build stacks 300ft high (400ft is considered desirable). On account of proximity to local housing developments, mechanical-electrical precipitation plant will be installed with a fly ash collection efficiency of 97 per cent. To obtain a normal full load stack velocity of 60ft/sec a nozzle is installed at the top of each of the two chimneys. Inside this nozzle, and concentric with it, is a second nozzle with damper which can be closed to raise the exit velocity to the 120ft/sec which is necessary under critical wind conditions to keep the stack plume well clear of the ground. A by-pass between the forced draught fans and the base of the stack maintains the high velocity at lower loads.

The cubic content of the building is 22 cu ft/kW. A semi-outdoor building was found to show no overall savings owing to additional costs of the boiler, radiation losses and temporary enclosures during construction and maintenance.

The station heat rate is expected to be 9,408 B.Th.U./kWh without make-up water and 9,625 with make-up water.

After a week-end shut-down the boiler-turbine combination would take 15 to 20 minutes to start, instead of 3 to 5 hours as previously required.

E.D.A. Film for Rome Festival

The E.D.A. film "Fifty Acres" has been selected for exhibition at the International Festival of the Agricultural Films at the Agricultural Exhibition being held in Rome from 3rd to 12th October.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 4th November from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

29271. General Electric Co., Ltd., Jenkins, R. O., and Michaelis, M.—Apparatus for the detection and/or measurements of ionizing radiation. 1st December, 1950. (699401.)

1949

10684. Ega Electric, Ltd., and Kilminster, G.—Electric switchgear and fuses. 24th July, 1950. (699403.)

25501. National Research Development Corporation.—Travelling-wave tubes. 4th October, 1950. (699173.)

28544. O'Shei, W. E.—Suction motors. 8th November, 1950. (699233.)

29486. Thorn Electrical Industries, Ltd., Strange, J. W., and Lockyer, J. S.—Brightness controls for electric lamps. 3rd November, 1950. (699234.)

1950

1586. General Electric Co., Ltd.—Electrical devices having a sealed envelope comprising portions cemented together. 10th April, 1951. (699175.)

4856. Maunder, H. N.—Circuit control switches and electric water heaters embodying same. 24th February, 1950. (699342.)

15644. Communications Patents, Ltd.—Electric circuit switching apparatus which is operable by a coin or the like. 21st September, 1951. (699409.)

16697. Communications Patents, Ltd.—Wired broadcasting systems. 4th October, 1951. (699411.)

17099. Kreutzer, C., and Peglow, H.—Apparatus for fishing by means of electricity. 7th July, 1950. (699346.)

17457. Hughes & Co., Ltd., F. A.—Consumable metal anodes. 18th June, 1951. Cognate application 28149, 17th November, 1950. (699239.)

18241. Bescocca, L.—Device for automatic control of electric or fluid circuits, alarms or signals. 21st July, 1950. (699183.)

18688. McCarthy, P. M.—Electric fuse holders. 26th October, 1951. (699184.)

19066. British Thomson-Houston Co., Ltd.—Ignition systems. 31st July, 1950. (699347.)

19308. Reiter, R.—Therapeutic electro-stimulator. 2nd August, 1950. (699241.)

23817. Siemens - Schuckertwerke Akt. - Ges.—Rotating field machines. 28th September, 1950. (699352.)

24778. Reyrolle & Co., Ltd., A.—Electric protective arrangements. 1st October, 1951. (699300.)

25059. Marconi's Wireless Telegraph Co., Ltd.—Amplitude modulated push-pull carrier wave transmitters. 4th January, 1951. (699353.)

26978. Santon, Ltd.—Electric immersion heating elements. 5th November, 1951. (699245.)

27664. Sterne & Co., Ltd., L., and Douglas, J.—Refrigerating apparatus. 6th February, 1952. (699248.)

28546. English Electric Co., Ltd.—Braking systems for hoists and the like. 16th November, 1951. Cognate application 1498, 19th January, 1951. (699249.)

28799. McMichael Radio, Ltd., and Cail, R. A.—Holders for thermionic valves and like devices. 26th November, 1951. (699190.)

30240. British Thomson-Houston Co., Ltd.—Mounting of sealed windows forming electrically resonant apertures. 6th December, 1951. (699355.)

1951

192. Larras, J. A., and Laurent, J.—Apparatus for generating waves. 2nd January, 1951. (699418.)

2197. Research Corporation.—Electrical precipitators. 29th January, 1951. (699192.)

2447. British Thomson-Houston Co., Ltd.—Eddy-current brakes with magnetic locking. 15th November, 1951. (699256.)

4891. British Insulated Callender's Cables, Ltd.—Joints for electric cables. 27th February, 1952. (699421.)

5066. Morris Motors, Ltd.—High-frequency electric transformers. 20th March, 1952. (699306.)

5738. Erie Resistor, Ltd., Williams, C. R., Blowers, G. G., and Evans, F. A.—Electric variable condensers. 7th March, 1952. (699363.)

6000. Entwisle, J. J.—Electric time switches. 13th March, 1951. (699197.)

9378. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Methods of liquefying gases and systems for carrying out such methods. 23rd April, 1951. (699262.)

10086. Telefonaktiebolaget, L. M. Ericsson.—Method for production of contact spring sets for electromagnetic relays or switches having insulated and supported contact springs. 30th April, 1951. (699199.)

12016. Electric & Musical Industries, Ltd.—Circuit arrangements for providing supply potentials. 14th May, 1952. (699312.)

13339. Metropolitan-Vickers Electrical Co., Ltd.—Regulating system for saturable magnetic circuits particularly for charged particle accelerators. 5th June, 1951. (699426.)

14906. General Electric Co., Ltd., and Anderson, S.—Ventilated electric lighting fittings. 23rd June, 1952. (699270.)

14921. Mond Nickel Co., Ltd.—Electric storage batteries. 11th June, 1952. (699271.)

15321. Cole, Ltd., E. K., and Martin, A. W.—Radio apparatus energized by alternating current mains. 30th June, 1952. (699272.)

15831. Bates, C. R., and Bates, M. E.—Electronic timing circuit. 3rd July, 1952. (699315.)

16767. Walsh, Ltd., E. A. & J. Y.—Electrical resistances. 14th July, 1952. (699428.)

18603. General Electric Co., Ltd., and Jones, D. D.—Impedance transformers. 7th August, 1952. (699379.)

18604. British Dielectric Research, Ltd.—Electrical capacitors. 6th August, 1952. (699274.)

20426. Arc Manufacturing Co., Ltd.—Electric transformers. 29th August, 1951. (699319.)

20912. Minshall, B.—Frequency divider or multiplier. 5th September, 1951. (699383.)

24943. Akt.-Ges. Brown, Boveri & Cie.—Constant-speed regulating device for regulation of the motors of a drive having a plurality of direct current motors which are individually fed from a common alternating current system by means of grid-controlled rectifiers. 25th October, 1951. (699389.)

28198. Marconi's Wireless Telegraph Co., Ltd.—Semiconductor rectifying and photo-sensitive elements. 8th July, 1952. (699329.)

29037. Fligue, W. de, and Lavallee, P.—Electromagnetic relays. 11th December, 1951. (699219.)

30485. Rheostatic Co., Ltd., and Sawyer, W. A.—Magnetic snap-action electric switches. 31st December, 1951. (699220.)

1952

316. Felten & Guilleaume Carlswerk Akt.-Ges.—Electric signalling cables. 4th January, 1952. (699221.)

1182. Bendix Aviation Corporation.—Electrical servo-systems. 15th January, 1952. (699433.)

1505. British Thomson-Houston Co., Ltd.—High-pressure shaft seals. 18th January, 1952. (699396.)

1986. British Thomson-Houston Co., Ltd.—Regulators for dynamo-electric machines. 24th January, 1952. (699281.)

4617. British Thomson-Houston Co., Ltd.—Electric motor control. 21st February, 1952. (699334.)

4953. Dynamatic Corporation.—Magnetic poles for eddy-current dynamo-electric machines. 26th February, 1952. (699335.)

5602. Ega Electric, Ltd., and Kilminster, G.—Electric switchgear and fuses. 24th July, 1950. Divided out of 699403. (699439.)

6597/8. Mono Pumps, Ltd. (Robbins & Myers, Inc.).—Electrically driven pump units. 13th March, 1952. (699436/7.) 6599. Helical-gear pumps and stators therefor. 13th March, 1952. (699438.)

11141. Electroacustic Ges.—Convertible sound pick-up devices. 2nd May, 1952. (699397.)

13681. British Thomson-Houston Co., Ltd.—Electric heaters. 29th May, 1952. (699230.)

16831. Allmanna Svenska Elektriska Aktiebolaget.—Electric high-frequency generator. 4th July, 1952. (699285.)

17730. Philips Electrical Industries, Ltd.—Discharge tubes comprising a metal envelope and for use at very short wavelengths. 14th July, 1952. (699286.)

17731. Philips Electrical Industries, Ltd.—Supply cathodes and discharge tubes comprising such supply cathodes. 14th July, 1952. (699287.)

18193. Babcock & Wilcox, Ltd.—Cyclone furnaces. 18th July, 1952. (699288.)

21548. Philips Electrical Industries, Ltd.—X-ray apparatus. 27th August, 1952. (699445.)

22425. General Electric Co.—Flow-control devices. 5th September, 1952. (699446.)

24580. Ateliers de Constructions Electriques de Charleroi.—Magnetic recorders with record tapes or the like of great width and/or length. 1st October, 1952. Addition to 678133. (699400.)

Conditions in Belgium and Luxembourg

Improved United Kingdom Exports

THE Convention of Economic Union (Belgolux) concluded in 1921 between Belgium and Luxembourg, and the widening of the area of economic union by the inclusion of the Netherlands (Benelux) in 1944, have had considerable effect upon the economic conditions in those countries, and the report of Mr. A. H. Tandy, Counsellor (Commercial) to H.M. Embassy in Brussels and H.M. Legation in Luxembourg ("Economic and Commercial Conditions in Belgium and Luxembourg," H.M. Stationery Office, price 3s 6d net) deals with the general situation in all the countries covered by the Union.

Dealing first with Belgium, Mr. Tandy says that output of electricity, abnormally high during the ndustrial boom of late 1950 and 1951, was 9,464 million kWh in 1952, mostly from thermal sources. Average increase of electric power output since 1946 has been 10 per cent annually, which is only surpassed by the United States and Italy. Industrial and non-industrial consumption now exceeds pre-war levels by 50 per cent and 100 per cent respectively and industry is producing 46 per cent of its requirements. A co-operative industrial power station was opened at Awirs, near Liège, in 1951. Belgian power stations are developing the utilization of unsaleable colliery by-products and refuse.

Production of engineering goods continued at a high level, and capital goods, especially railway material, electrical equipment and machine tools, continue to benefit from high demand. United Kingdom exports to the two countries in 1950 were valued at £53 million, and in 1951, £57 million. The improvement in United Kingdom exports in recent years has owed much to larger sales of machinery and electrical equipment. The total "Belgolux" imports of electrical and electro-technical machines and apparatus in 1951 were valued at fr. 2,740 million and fr. 3,204 million in 1952, the U.K.'s share being fr. 279·7 million and fr. 377·9 million in the respective years. Of the total length of track in the Belgian railway system (5,030 km), 170 km is electrified. Work is proceeding on the electrification of the Brussels–Ostend, Brussels–Liège, and Brussels–Lamur lines, and the electrification of a further 1,500 km is contemplated.

In Luxembourg the capacity of generating plant in 1952 totalled 184,000 kW, the bulk of which was installed in thermal stations belonging to steelworks. Production in 1952 totalled 831·5 million kWh, as compared with 809·8 million in 1951.

Record Swiss Output

THE total energy generated by Swiss power stations during the year to 30th September last reached the new record of 12,583 million kWh (against 12,191 million kWh in 1950–51). Thermal generators were responsible for 126 million kWh (against 56 million kWh). Normal consumption, i.e. exclusive of boilers and pumps for feeding the reservoirs, rose from 10,429 million to 11,131 million kWh, or by 6·7 per cent, and total consumption increased from 11,554 million to 12,408 million kWh (4·3 per cent). The potential annual production of stations put into service during 1952 is 165 million kWh, while that of stations under construction is no less than 3,545 million kWh.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — BRISBANE. — 23rd October. L.v. motor starters. (E.S.B. 4201/53. Ten/7121.)*

Basildon. — 31st October. U.D.C. Submersible pump installation, Birch Close borehole. (See this issue.)

Belfast. — 6th November. City Council. Water screening plant. (See this issue.)

7th October. Electrical installation at the new district fire station, Lisburn Road. Surveyor's Department, Architectural Section, City Hall.

Chertsey. — 7th October. U.D.C. Street lighting improvement scheme, London Street and Bridge Road. Surveyor, Council Offices, Guildford Street.

Co. Down.—30th September. County Welfare Committee. Electrical installation and fire alarm at St. Leonard's West premises, Warren Point. D. Whatmore Bell, 41, Royal Avenue.

1st October. County Education Committee. Electrical installation at Ballynahinch intermediate school. J. R. W. Murland, consulting engineer, 13, Wellington Place, Belfast.

East Dereham.—12th October. U.D.C. Street lighting equipment. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. Erection of distribution lines in South Angus. (See this issue.)

Egypt.—CAIRO.—6th October. Cairo Electricity and Gas Administration. Transformers. (E.S.B. 4194/53. Ten/7119.)*

India.—NEW DELHI.—28th October. Director General of Supplies and Disposals. Electric cables. (E.S.B. 4206/53. Ten/7132.)*

King's Lynn.—19th October. T.C. Electrically driven vertical unchokeable sewage pump, with equipment. John Taylor & Sons, Artillery House, Artillery Row, London, S.W.1.

New Zealand.—WELLINGTON.—5th November. Director-General (Stores Division), G.P.O. Wiper cords. (E.S.B. 4229/53. Ten/7128.)* 11th November. Electrolytic and fixed condensers. (E.S.B. 4228/53. Ten/7130.)*

4th November. Post and Telegraph Department. H.f. twin conductor cable. (E.S.B. 4225/53. Ten/7140.)*

North Lindsey. — 19th October. Water Board. Three electric pumping sets at Barrow-on-Humber pumping station. C. Cooper, engineer to the Board, Consorts Avenue, Scunthorpe.

Pakistan. — KARACHI. — 30th September. Director General of Supply and Development. Diesel engine driven generating sets. (E.S.B. 4211/53. Ten/7126.)*

Preston.—9th October. Borough engineer and Surveyor's Department. Electrical installations in houses and flats on Brookfield Estate. (See this issue).

South Africa. — PRETORIA. — 15th October. Union Tender and Supplies Board. Radio valves. (E.S.B. 4015/53. Ten/7115.)* 15th October. Lamps for film projectors. (E.S.B. 4244/53. Ten/7135.)*

Southwell.—16th October. R.D.C. Pumping plant and auxiliary gear in connection with Lowdham area water supply scheme. A. H. S. Waters, 25, Temple Row, Birmingham, 2.

United States. — DENVER. — 19th October. Bureau of Reclamation. Electrical equipment for the Central Valley Project, California. (E.S.B. 3830/53. Ten/7114.)*

Uruguay. — MONTEVIDEO. — 3rd November. Usinas Electricas y los Telefonos del Estado. Two special transformers. (E.S.B. 4349/53. Ten/7134.)*

Walthamstow. — 2nd October. Borough Council. 255 sets of 140 W sodium discharge lighting and electrical equipment, Forest Road, Chingford Road and Hoe Street. Borough architect, Town Hall, E.17.

*Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Alnwick (Northumberland). — U.D.C. Provision of street lighting on the trunk road at Alnwick.—B. L. Oliver (Birtley).

Bradford.—City Council Education Committee. Electrical installations at the Cathedral vicarage (£194).—E. Wilkinson & Sons.

Durham. — County Education Committee. Electrical installation at Ryhope Robert Richardson Grammar School (£3,400).—Electra, Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashington.—Houses (64) by direct labour; surveyor, U.D.C.

Barton-on-Humber.—Houses (42) on Tofts Road estate for U.D.C.

Birkenhead. — Houses (203), Woodchurch estate; borough architect.

Birmingham.—Houses (103), proposed on site at Shenley; Bournville Village Trust.

Construction of St. Martin's Toll Market; borough engineer and architect.

Bristol.—Police station, The Grove; city architect.

Houses (48), St. Jude's area; Wm. Cowlin & Sons, Ltd., Stratton Street.

Burnley.—Additions to Municipal College; borough surveyor, 22/24, Nicholas Street.

Cannock Chase.—Extensions to Mining and Technical College; Staffs county architect, County Buildings, Martin Street, Stafford.

Carlisle.—Extensions at Castle Street, for Bulloughs & Co., Ltd.; John Laing & Sons, Ltd., Dalston Road.

Coventry.—Y.W.C.A., The Butts; C. F. Redgrave & Partners, architects, 6, The Quadrant.

Cradley Heath.—Extensions to factory; Joseph Shakespeare & Co., ironworkers, Old Hill.

Cudworth (Yorks).—Houses (92), at Darfield Road Site for U.D.C.; Geo. Calverley & Sons, Ltd., Evington Valley Road, Leicester.

Dagenham.—Houses (208) Marks Gate estate; borough engineer.

East Sussex.—Juvenile Courts at Battle and Mark Cross Police Courts; county architect, County Hall, Lewes.

Exeter.—Houses (144), at Whipton Barton North; Harold B. Rowe, city architect, Municipal Offices.

Farnworth.—Houses (381) between Highfield Road and Plodder Lane South Site for T.C.

Gateshead - on - Tyne. — Houses (178), Wrekenton neighbourhood; borough architect.

Glasgow.—Remand home on estate at Barlanark; city architect, 20, Trongate.

Grimsby.—Police centre in Victoria Street South; J. V. Oldfield, borough surveyor, Town Hall Square.

Halifax. — Special school at Northowram (£39,000); G. Holden, borough surveyor, Crossley Street.

Harlow.—Works; Johnson, Matthey & Co., Ltd., 73/83, Hatton Garden, E.C.1.

Harrow.—Flats and maisonnettes (44), at Stone Grove, Edgware, and houses (31), at Latimer Gardens; J. H. Melville Richards, surveyor, Cottesmore, Uxbridge Road, Stanmore.

Hartley Wintney.—Dwellings (92), Pankridge Street; council surveyor.

Hendon.—Branch library, Orange Hill, Burnt Oak; borough engineer.

Hull.—Reconstruction of central fire station, Worship Street; Andrew Rankine, city architect, Lowgate.

Llandudno.—Flats (26) and houses (23) at the Tre Creuddy estate for U.D.C.; F. Tyldesley, Queen's Road.

London.—High Holborn.—Showrooms and offices; James Webb & Son, Ltd., 326, St. John Street, E.C.1.

North Acton.—Works extensions; Cheseborough Manufacturing Co., Ltd., Victoria Road, N.W.10.

Westminster.—New building for Grey Coat Girls' School, Grey Coat Place; John Greenwood, Ltd., builders, 12, Arthur Street, E.C.4.

Manchester.—Factory at Leestone Road, Northenden, for Taverner Ajello, Ltd.; Major Bull, architect, 91, High Street, Cheadle, Ches.

Middlesbrough.—Branch library at Thorntree; borough surveyor.

Morpeth.—Two new ward blocks for 80 patients, St. George's Hospital; Newcastle-on-Tyne Regional Hospital Board, Osborne Road, Newcastle.

New hotel at Stobhill (£16,000); S. H. Lawson, Emerson Chambers, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Extensions to City Airport (£150,000); city engineer.

Adaptation of 16 to 18 Hood Street for showrooms and warehouses (£30,000); T. A. Page, Son & Hill, 75, King Street, South Shields.

Aged persons' hostel, Kenton Hall; A. K. Tasker & Austin Child, architects, 25, New Bridge Street.

Northallerton.—Adaptation of Oak Mount as home for old people (£25,500); county architect.

Northampton. — Rebuilding factory after fire; Byfield Leather Co., Ltd., Byfield Road.

Peterborough. — Chest Clinic at Thorpe Road; Ruddle & Wilkinson, architects, Long Causeway Chambers.

Pinner.—Houses (31), Latimer Gardens; surveyor to Harrow U.D.C., Council Offices, Stanmore.

Portsmouth. — Southern Boys' Grammar School; city architect.

Redditch.—Houses (250) on new estate on the Redditch-Studley Road; L. O. Wilkes, surveyor, Council House.

Rochdale. — Extensions for *Rochdale Observer*, Drake Street; R. & T. Howarth, Ltd.

Southport.—Houses (256), Radnor Drive area; R. E. Perrins, town clerk, Town Hall.

Stoke-on-Trent.—Civic art gallery, Bell Pottery; W. A. Bott, borough surveyor, Town Hall.

Swansea.—Factory, Brynhyfryd; F. Holt & Son, Ltd., Orange Street.

Todmorden.—Houses (38) and flats (48) at Hallroyd estate; borough surveyor.

Tunbridge Wells.—Development of site at Hawkenbury to provide 240 houses; G. T. Crouch, Ltd., Thames Street, Kingston-on-Thames.

Warwick. — Married men's and married officers' quarters (185 houses) near Tashbrook; Air Ministry.

Welwyn Garden City.—Houses (118), Morelands area; Louis de Soissons & Partners, architects, Midland Bank Chambers.

Office; Imperial Chemical Industries (Plastics Division), Black Farn Road.

Whiston.—Houses (228) on site at Royal Oak; Watson Garbutt, R.D.C. surveyor, Delph Lane.

Worcester.—Extensions, Grammar School for Girls; Watkins & Decker, quantity surveyors, 13, Gray's Inn Square, London, W.C.1.